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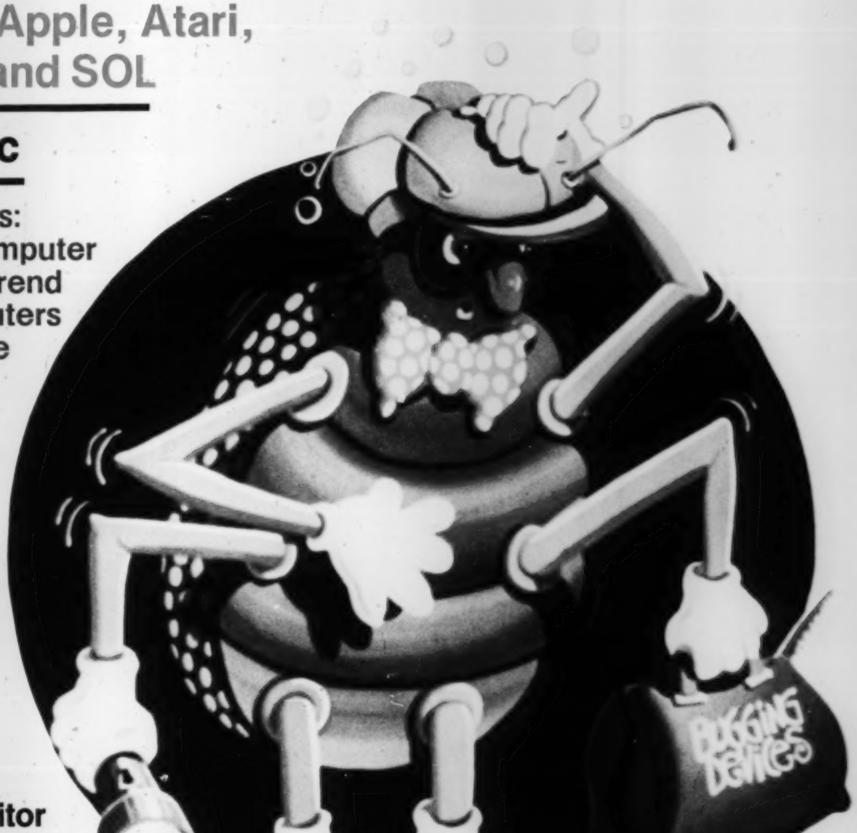

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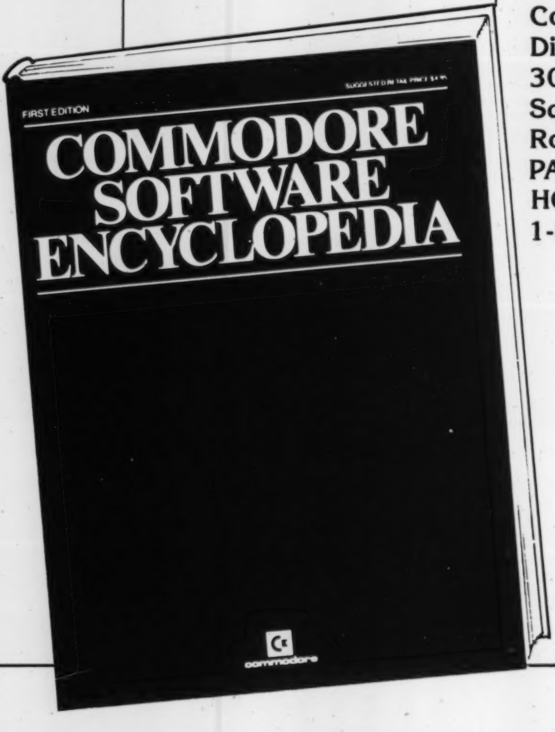
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VOLUME 7, NUMBER 12

Creative Computing (ISSN 0097-8140) is published monthly by Creative Computing, P.O. Box 789-M, Morristown, NJ 07960. Second Class postage paid at Lincoln, NE 68501.
Editorial offices located at 39 East Hanover Ave., Morris Plains, NJ 07950. Phone (201) 540-0445.
Domestic Subscriptions: 12 issues $20; 24 issues $37; 36 issues $53. Send subscription orders or change of address (P.O. Form 3575) to Creative Computing, P.O. Box 789-M, Morristown, NJ 07960. Call 800-631-8112 toll-free (in New Jersey call 201-540-0445) to order a subscription (to be charged only to a bank card).
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Creative Computing is printed by Mid-America Webpress, Lincoln, NE 68501.

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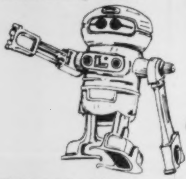

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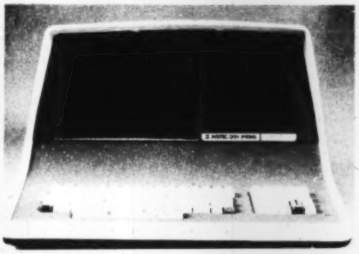

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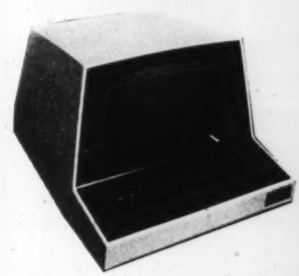

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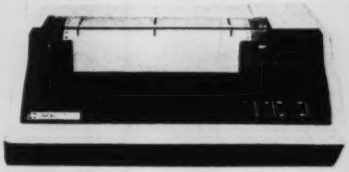

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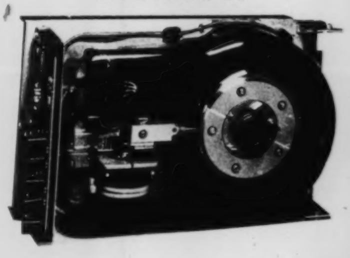

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YET ANOTHER BUBBLE BURSTS

We've mentioned several times in this column that the expectation that bubble memory devices would replace other mass storage devices such as disks and tapes has just not been happening. Now, further clouding the future of bubble memories, National Semiconductor has announced its withdrawal from the field. This leaves Intel, now specializing in 128K-byte devices, as the major US supplier of bubble memories. Motorola is also still committed to the field. However, in contrast to the eight or ten manufacturers who jumped on the bubble band wagon five or six years ago, the fact that only two are still committed sheds serious doubt on the future of bubble memories as a viable and economic device.

Stewart Sando, marketing manager for Intel predicted the cost for 128K bytes of bubble memory will fall below $100 in the near future, thus making it competitive with other types of solid state memory or Winchester disks.

While Intel's largest bubble memory is currently the 128K-byte device, the firm will introduce a 512K-byte device in the not too distant future according to Sando. By 1985 that device will cost about $150.

So, amid the dropouts, Intel remains. Will they be able to repeat the success of their line of microprocessors (4004, 8008, 8080, . . .) or will they eventually give up on bubble devices? Only time will tell.

AT&T SPLITS WHILE IBM UNIFIES

The final stages of the most extensive reorganization in corporate annals is nearing completion at AT&T as the company prepares for its entry into the open telecommunications and computer markets. At the heart of the reorganization is an intricate blueprint calling for reassignment of employees into the so-called fully separated subsidiary. The FSS unit may start life with up to 150,000 employees and $3 billion in assets drawn from the existing Bell System. FSS will include all customer premise equipment to be offered on a nontariffed basis as well as business communications offerings such as the now dormant Advanced Communications Service.

FSS will consist of two principle divisions handling marketing, sales, installation and support services: the Business Systems Division for business customers and large national accounts and the Consumer Products Division for residential users and small commercial enterprises.

While Bell splits up, IBM is rumored to be planning a major marketing reorganization that eventually will bring together all of its data processing, general systems, and office products divisions marketing personnel into a unified field sales force. IBM, tight lipped as usual, is neither confirming or denying these rumors.

Such a reorganization would make sense since many commercial customers now have to deal with as many as three separate IBM divisions to buy data processing equipment, word processing equipment, and small computers. This new reorganization would mean that a customer would have a single interface to the company ending any confusion arising from the present set-up.

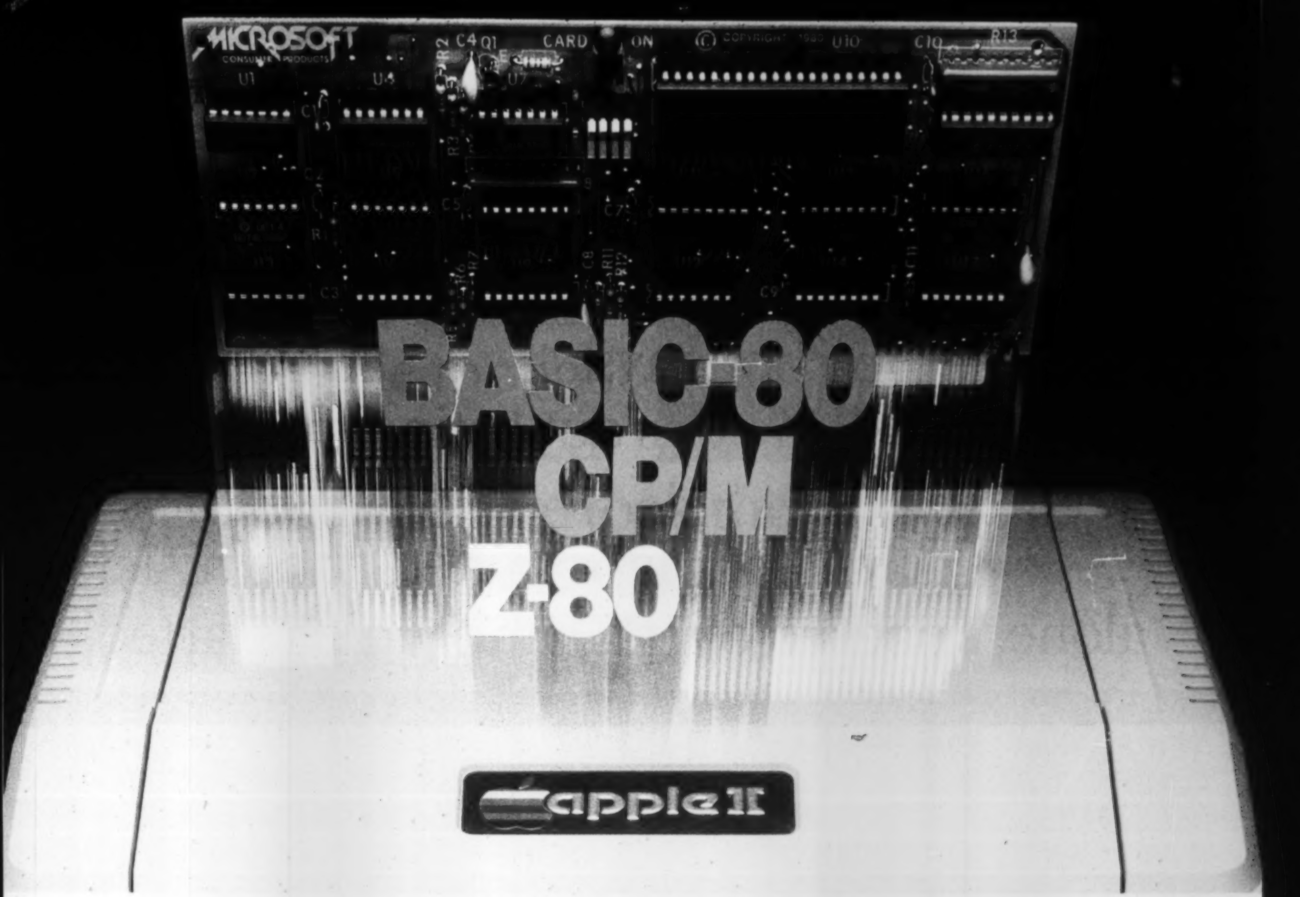
COMPUTERLAND NATIONAL ACCOUNTS PROGRAM

With Apple computer still piecing together its national accounts sales program, Computerland has initiated its own plan for marketing small computers to major corporations, a strategy that will put IBM and Apple on a collision course in the corporate accounts marketplace. The program is designed to handle, from one central location at San Leandro, high volume computer sales to large corporations with multiple locations. This plan is being timed to coincide with the arrival of the new IBM computer at Computerland as well as the Xerox 820, both manufacturers of which are familiar to corporate customers.

XEROX ENTERS ARTIFICIAL INTELLIGENCE MARKET

Within the past year two smaller companies have introduced LISP-based systems for research in artificial intelligence. They are Symbolics, Inc. and LISP Machine, Inc.

Xerox has now joined the fray with its 1100 machine and accompanying Interlisp D software. Both the machine and software were developed at Xerox Palo Alto Research Center. The hardware includes a bit-mapped display, keyboard and mouse pointing device (similar to that used on the Star). The system has 1.15 Mbytes of memory and virtual address space of 4 million 16-bit words. Also included are a 23 Mbyte Winchester disk drive and interfaces to Ethernet and other external devices. The system is priced at $60,000 in between the price of a basic Symbolics 3600 System ($50,000) and the LMI System ($70,000).



Turn your Apple into the world's most versatile personal computer.

The SoftCard™ Solution. SoftCard turns your Apple into two computers. A Z-80 and a 6502. By adding a Z-80 microprocessor and CP/M to your Apple, SoftCard turns your Apple into a CP/M based machine. That means you can access the single largest body of microcomputer software in existence. Two computers in one. And, the advantages of both.

Plug and go. The SoftCard system starts with a Z-80 based circuit card. Just plug it into any slot (except 0) of your Apple. No modifications required. SoftCard supports most of your Apple peripherals, and, in 6502-mode, your Apple is still your Apple.

CP/M for your Apple. You get CP/M on disk with the SoftCard package. It's a powerful and simple-to-use operating system. It supports more software than any other microcomputer operating system. And that's the key to the versatility of the SoftCard/Apple.

CIRCLE 168 ON READER SERVICE CARD

BASIC included. A powerful tool, BASIC-80 is included in the SoftCard package. Running under CP/M, ANSI Standard BASIC-80 is the most powerful microcomputer BASIC available. It includes extensive disk I/O statements, error trapping, integer variables, 16-digit precision, extensive EDIT commands and string functions, high and low-res Apple graphics, PRINT USING, CHAIN and COMMON, plus many additional commands. And, it's a BASIC you can compile with Microsoft's BASIC Compiler.

More languages. With SoftCard and CP/M, you can add Microsoft's ANSI Standard COBOL, and FORTRAN, or Basic Compiler and Assembly Language Development System. All, more powerful tools for your Apple.

Seeing is believing. See the SoftCard in operation at your Microsoft or Apple dealer. We think you'll agree that the SoftCard turns your Apple into the world's most versatile personal computer.

Complete information? It's at your dealer's now. Or, we'll send it to you and include a dealer list. Write us. Call us. Or, circle the reader service card number below.

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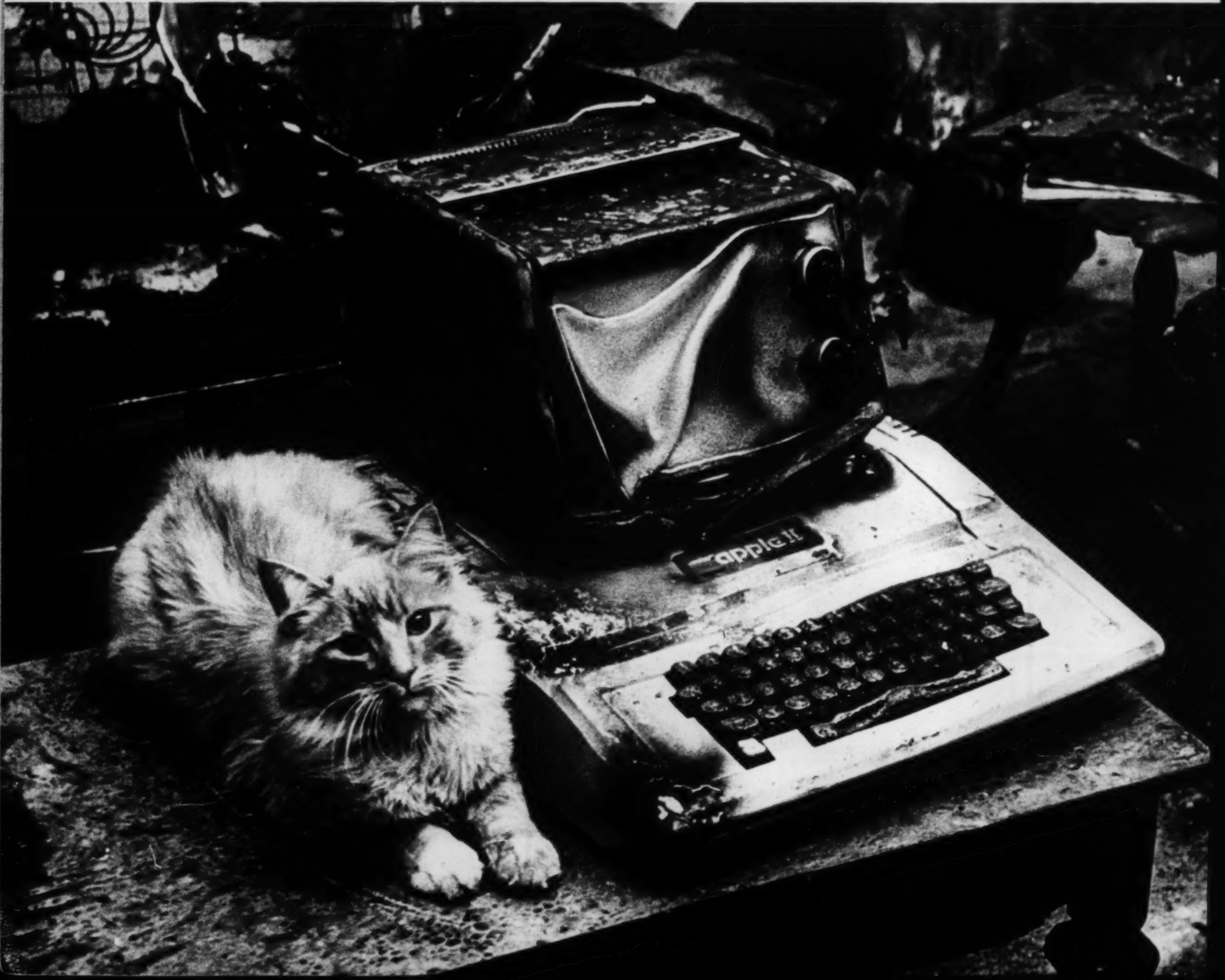
Baked Apple.

Last Thanksgiving, a designer from Lynn/Ohio Corporation took one of the company's Apple Personal Computers home for the holidays.

While he was out eating turkey, it got baked.

His cat, perhaps miffed at being left alone, knocked over a lamp which started



a fire which, among other unpleasantries, melted his TV set all over his computer. He thought his goose was cooked.

But when he took the Apple to Cincinnati Computer Store, *mirabile dictu,* it still worked.

A new case and keyboard made it as good as new.

Nearly 1,000 Apple dealers have complete service centers that can quickly fix just about anything that might go wrong, no matter how bizarre.

So if you're looking for a personal computer that solves problems instead of creating them, look to your authorized Apple dealer.

You'll find everything well-done.

The personal computer. apple®

For the authorized dealer nearest you, call (800) 538-9696. In California, call (800) 662-9238. Or write: Apple Computer Inc., 10260 Bandley Dr., Cupertino, CA 95014.

CIRCLE 117 ON READER SERVICE CARD

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Apple is a trademark of Apple Computer Inc.

Alkemstone is a trademark of Level-10.
This offer void where prohibited by law.

CIRCLE 253 ON READER SERVICE CARD

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NECC-82 Call for Papers

The 1982 National Educational Computing Conference (NECC-82) will be held in Kansas City, MO, June 28-30, 1982. The purpose of the conference is to provide a forum for discussion among individuals interested in educational computing.

Authors are invited to submit papers describing experiences with computer use in the classroom or the consequences of such use on the educational process in general. Papers should report concrete results or be survey or tutorial papers which include a synthesis and thorough evaluation. The deadline for papers is January 15, 1982.

Specifications for paper submittal may be obtained from: Gerald L. Engel, Computer Science Department, Christopher Newport College, 50 Shoe Lane, Newport News, VA 23606, or E. Michael Staman, NECC-82 General Chairman, Campus Computing Services, University of Missouri-Columbia, 305 Jesse Hall, Columbia, MO 65211.

National Careers for the Disabled Symposium

The first National Careers for the Disabled Symposium, offering first-hand information to career-oriented disabled persons, will be sponsored by Commodore Business Machines, Inc., in association with Careers for Disabled, Inc., and will be held at the Convention Center in Baltimore, MD, December 4-6, 1981.

Each workshop will include a special lecture on how to obtain training and then market new or existing skills in areas such as computer technology, starting your own business, continuing your education, sales, government and unions, finance, printing and the graphic arts, clerical, travel and leisure, food services, communications, and repair trades.

Commodore Business Machines, Inc., Computer System Division, 681 Moore Rd., King of Prussia, PA 19406, 215-337-7100.

Graphic Arts and the Computer

Graphic arts and the computer, a growing relationship that is affecting all aspects and modes of visual communications, is the subject of a two-day conference on December 14 and 15 to be sponsored by the newly-formed Pratt Center for Computer Graphics in Design, a user-oriented, non-profit organization of Pratt Institute.

The Conference, which will be held in New York's Halloran House, will offer more than a dozen experts on such topics as Computer-Aided Publication Systems, Computer Page Makeup and Design, Graphics in Video, the Video Palette for Art Direction, Personal Video, Videotext and Interactive Television, 3D Computer Animation, Computer Graphic Technical Illustration, and Computer Slices and Multimedia.

For more information on the December Conference, which is called "Computer-Aided Graphic Arts and Visual Communication," and on a similar one in Los Angeles on March 11 and 12, contact Perry Jeffe at 914-631-8772, or Jan Orzeck-Brynes at Pratt Institute, 212-636-3504.

Employment Register

The Tenth Annual Computer Science Employment Register will be conducted at the Indianapolis Computer Science Conference, February 8-11. 1982. This Register aids in matching computer scientists and data processing specialists with employer opportunities.

The purpose of the Register is to provide a mechanism for establishing contact between applicant and employer in a professional manner. The Register operates as follows: the applicant completes a form giving identifying information, education, publications, experience, interests, references, position and salary desired. The employer completes a similar form giving: identifying information; position available along with starting date, salary, and benefits; and education, experience, and specialization requirements for the position. This information enables applicant and employer to determine the desirability for follow up.

Both applicants and employers must file their registration on official forms which may be obtained from Orrin E. Taulbee, ACM Computer Science Employment Register, Department of Computer Science, University of Pittsburgh, Pittsburgh, PA 15260.

Closing date for acceptance of forms is January 8, 1982.

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HillShafer

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ATARI

48K — w/disk

CRYSTALWARE

48 — w/disk

APPLE

48K — w/disk

THE FINEST IN FANTASY GAME SOFTWARE

At Crystal we are doing our best to provide the finest state-of-the-art graphic adventure software in the world. Our list of credits include the first indoor-outdoor graphic adventure, the first multi-disk graphic adventure, and now for the Atari, the first graphic adventure in the world which includes screen scrolling and animation. The era of the text adventure and games which are simple combinations of static graphics and text is rapidly drawing to a close. We attempt to utilize the full potential of your computer. True, many of our games use up to 48K and we only deal in disk products, but there are a lot of users out there who have worked hard to upgrade their systems to the max and we think they deserve games that will give their computer system a run for its money.

★★★ ADVENTURE GAMES ★★★

1-THE HOUSE OF USHER- Haunted house type adventure game with scrolling in the Atari version. Wander the creepy hallways of the three story castle based on Edgar Allen Poe's short story of the same name. Written in graphics, of course, with animation and sound. We have introduced a new mystery for another $100 prize. $29.95/1 disk

2-FANTASYLAND 2041 A.D.- The largest disk based adventure game in the world (that we know of). Enter the Hall of Heroes and prepare yourself for the greatest fantasy-role-playing game you will see for years to come. To win you must survive Congoland, Arabia, King Arthur, Captain Nemo, Olympus (a sea voyage), and Dante's Inferno (Hell itself). In both the Atari and Apple versions it takes up more than 400,000 bytes of memory and uses more than 400 hires screens. The winner of the contest described in the manual with this game will receive $1000.00 and a bronze trophy. We have pushed the award date forward to February 1982 to allow more people to participate in the contest. $59.95/6 disks

3-GLAMIS CASTLE- Yes, Pat and I are on our way to Britain to stay in the dreaded Glamis Castle. If we survive our real life adventure, we'll be measuring it and will be able to provide you with a 3-D game based on this ancient haunted site where King Duncan met his end at the hands of Macbeth. Our good friend, Mark Benioff, after much research, said there's a mystery room that has never been found in this castle and a half beast, half-man creature that guards a treasure therein. Our stay will be covered by the British media and we hope to share our experience with you through the writing of this game. $49.95/2 disks

4-BENEATH THE PYRAMIDS- You are an archaeologist in 1932 and must find your way through the perilous chambers beneath the pyramids to discover a golden statue of the cat goddess Bast. This game is in hires graphics, includes sound, your little man actually moves through the corridors which you can see on the screen. The monsters are animated and very agressive. There is a new $100 prize for the first to solve the mystery; which is a toughie! $29.95/1 disk

★★★ SPACE GAMES ★★★

5-GALACTIC QUEST- An excellent combination of Star Trek and Space Trader. Battle the animated Vegan fighters as you warp from galaxy to galaxy. At the same time, you may land on and trade with hundreds of planets. Super hires graphics and lots of sound. This has been one of our most popular games. $29.95/1 disk

6-SANDS OF MARS- Take an exciting voyage to the planet Mars via the Starship Herman. This game compared to the rest, is second only to Fantasyland 2041 A.D. It includes scrolling on the Atari and hundreds of full screen graphics. You can move your little man through the terrain of Mars; if, of course, you survive the exciting journey to Mars, which occupies the whole first disk. There is a new mystery and another $100 prize just waiting for some clever adventurer out there. Good luck! $39.95/2 disks

★★★ WAR GAMES ★★★

7-WORLD WAR III- You Atari gamers will have to see this in the Atari version to believe it! If your tired of war games which take 15 minutes a move and have a manual the size of a telephone book; but still want a complex, real-time action war game-this is it! It is designed for two arm-chair generals which may manuever up to 128 seperate type of units at a time. The game displays a map of Iran & Iraq in the first scenario and later on you will find yourself moving nuclear submarines and battleships through two world wars. This is not a boring copy of a board based game but an original war game which takes a lot of skill and may take weeks to play. $29.95/1 disk

8-WATERLOO II- If you had been Napolean would you have done a few things differently? Well as you approach this final battle you are equipped with the same forces, face the same opposition, and survey the same terrain which he did. We have done a great deal of research to make this historically accurate as well as extremely complex. Even the angle of sight, fatigue of the individual soldier, and his psychological profile are included in the calculations. Oh by the way, your opposition is no slouch. You may find it more difficult to change the course of history than you think! $49.95/2 disks

★★★ ARCADIA ★★★

9-LASAR WARS- Hires-3d space war simulation. Protect the earth from alien invaders. $29.95

10-LITTLE CRYSTAL- The first of our line of education software, which will be completed by December. It includes a very fine version of Hangman, Mr. Music; which transforms the computer into a piano, Gunk-a hilarious shoot-em up game, and Storytime- an anthology of bedtime stories featuring Herman, the cat, Oscar, the Hamster, and of course, Little Crystal. $39.95

11-IMPERIAL WALKER- A fine game pack written by our Atari programmer, Michael (graphics) Potter. Includes the Walker animation which is superb, Gunfight, and Lasar Nim, a game of 'how many robots'. $29.95

VISA

12-ADVENTURE PACK- (#1-4) $112

13-SPACEOUT- (#5-6) $58

14-THE WARRIOR- (#7-8) $64

15-ARCADE- (#9-11) $60

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48K — w/disk

CRYSTALWARE

TRS-80

48 — w/disk

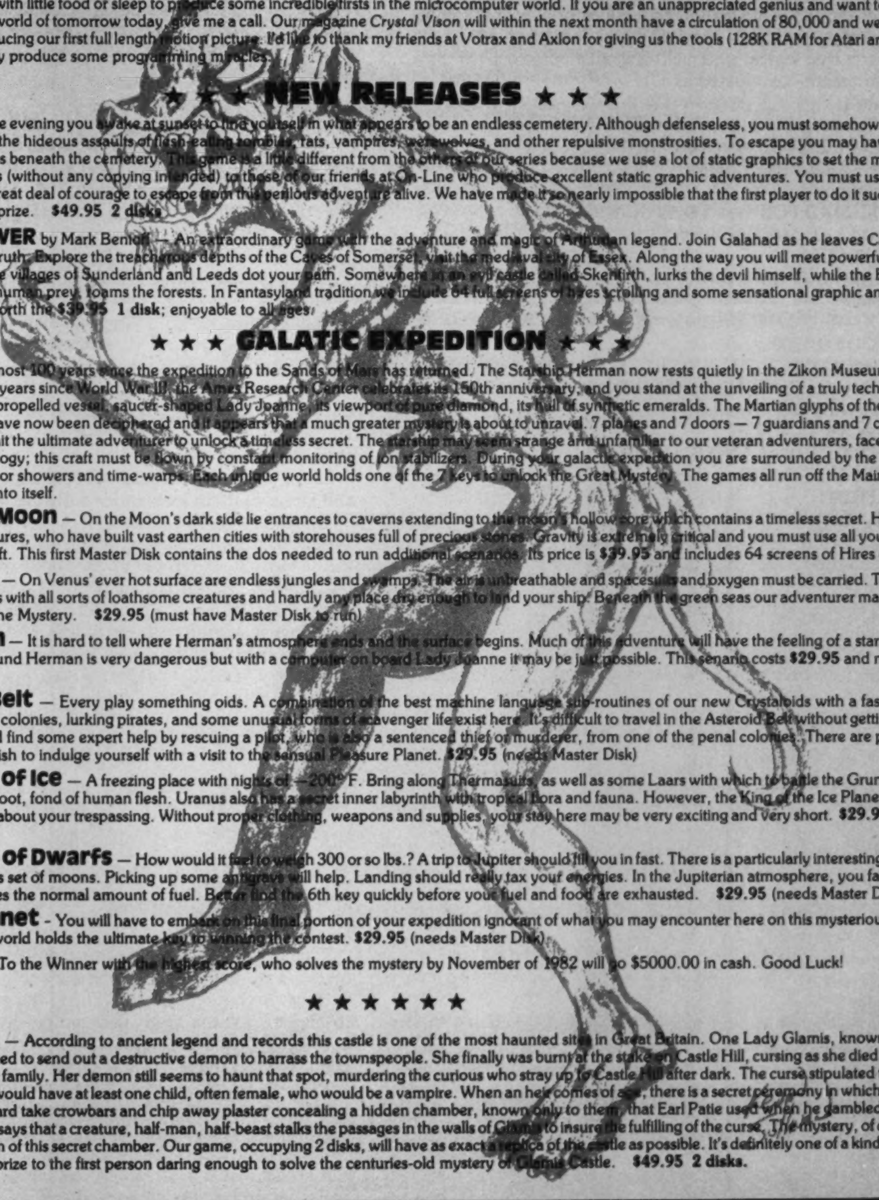
THE FINEST IN FANTASY GAME SOFTWARE

APPLE

48K — w/disk

"Having previewed over fifty of your competitors' games, I can assure you that your use of scrolling far exceeds anything I've seen for the Atari and, of course, for the Apple. I'm very impressed by the dedication and quality that your company exhibits by virtue of this demo." **David Sosna** — Associate Producer, Universal Pictures

Crystal has done its best to become the Porsche of the computer game industry. New scrolling techniques, video disk games, a real-life fantasyland — our mad programmers toil onward with little food or sleep to produce some incredible firsts in the microcomputer world. If you are an unappreciated genius and want to join our staff to help create the world of tomorrow today, give me a call. Our magazine *Crystal Vison* will within the next month have a circulation of 80,000 and we look forward very soon to producing our first full length motion picture. I'd like to thank my friends at Votrax and Axlon for giving us the tools (128K RAM for Atari and a vocal text synthesizer) to truly produce some programming miracles.



★ ★ ★ NEW RELEASES ★ ★ ★

THE CRYPT — One evening you awake at sunset to find yourself in what appears to be an endless cemetery. Although defenseless, you must somehow find your way out or perish from the hideous assaults of flesh-eating zombies, rats, vampires, werewolves, and other repulsive monstrosities. To escape you may have to descend into the catacombs beneath the cemetery. This game is a little different from the others of our series because we use a lot of static graphics to set the mood. It is similar in some respects (without any copying intended) to those of our friends at On-Line who produce excellent static graphic adventures. You must use all your common sense and a great deal of courage to escape from this perilous adventure alive. We have made it so nearly impossible that the first player to do it successfully will receive a $200.00 prize. **$49.95 2 disks**

QUEST FOR POWER by Mark Beniofi — An extraordinary game with the adventure and magic of Arthurian legend. Join Galahad as he leaves Camelot in search of the Scroll of Truth. Explore the treacherous depths of the Caves of Somerset, visit the medieval city of Essex. Along the way you will meet powerful wizards and great prophets. The villages of Sunderland and Leeds dot your path. Somewhere in an evil castle called Skenfirth, lurks the devil himself, while the Evil Giant Gogmogo, hungry for human prey, roams the forests. In Fantasyland tradition we include 64 full screens of hires scrolling and some sensational graphic and animation sequences. Well worth the **$39.95 1 disk**; enjoyable to all ages.

★ ★ ★ GALATIC EXPEDITION ★ ★ ★

The year is 3021, almost 100 years since the expedition to the Sands of Mars has returned. The Starship Herman now rests quietly in the Zikon Museum in New Brisbane. It's nearly 80 years since World War III, the Ames Research Center celebrates its 150th anniversary, and you stand at the unveiling of a truly technological wonder — the first ion-propelled vessel, saucer-shaped Lady Joanne, its viewport of pure diamond, its hull of synthetic emeralds. The Martian glyphs of the Meshim and those of Lemuria have now been deciphered and it appears that a much greater mystery is about to unravel. 7 planes and 7 doors — 7 guardians and 7 candles. 7 strange new worlds await the ultimate adventurer to unlock a timeless secret. The starship may seem strange and unfamiliar to our veteran adventurers, faced with its marvelous new technology; this craft must be flown by constant monitoring of ion stabilizers. During your galactic expedition you are surrounded by the flickering heavens, beset by meteor showers and time-warps. Each unique world holds one of the 7 keys to unlock the Great Mystery. The games all run off the Main Module which also is a game unto itself.

From Earth to Moon — On the Moon's dark side lie entrances to caverns extending to the moon's hollow core which contains a timeless secret. Here live a race of burrowing creatures, who have built vast earthen cities with storehouses full of precious stones. Gravity is extremely critical and you must use all your skills to manually land your craft. This first Master Disk contains the dos needed to run additional scenarios. Its price is **$39.95** and includes 64 screens of Hires graphics.

Mists of Venus — On Venus' ever hot surface are endless jungles and swamps. The air is unbreathable and spacesuits and oxygen must be carried. This world is especially treacherous with all sorts of loathsome creatures and hardly any place dry enough to land your ship. Beneath the green seas our adventurer may find the second key to solving the Mystery. **$29.95** (must have Master Disk to run)

Planet Herman — It is hard to tell where Herman's atmosphere ends and the surface begins. Much of this adventure will have the feeling of a starship submarine. Navigating around Herman is very dangerous but with a computer on board Lady Joanne it may be just possible. This senario costs **$29.95** and needs the Master to run.

The Asteroid Belt — Every play something oids. A combination of the best machine language sub-routines of our new Crystaloids with a fast moving adventure game. Penal colonies, lurking pirates, and some unusual forms of scavenger life exist here. It's difficult to travel in the Asteroid Belt without getting blown up. Perhaps you should find some expert help by rescuing a pilot, who is also a sentenced thief or murderer, from one of the penal colonies. There are places for trading and you may wish to indulge yourself with a visit to the sensual Pleasure Planet. **$29.95** (needs Master Disk)

Uranus - World of Ice — A freezing place with nights of −200° F. Bring along Thermasuits, as well as some Laars with which to battle the Grungik, a 12 foot tall relative of Big Foot, fond of human flesh. Uranus also has a secret inner labyrinth with tropical flora and fauna. However, the King of the Ice Planet, Norion may have his own idea about your trespassing. Without proper clothing, weapons and supplies, your stay here may be very exciting and very short. **$29.95** (needs Master Disk to run)

Jupiter - World of Dwarfs — How would it feel to weigh 300 or so lbs.? A trip to Jupiter should fill you in fast. There is a particularly interesting red spot on Jupiter and a curious set of moons. Picking up some antigravs will help. Landing should really tax your energies. In the Jupiterian atmosphere, you fall fast! Be prepared to use 10 times the normal amount of fuel. Better find the 6th key quickly before your fuel and food are exhausted. **$29.95** (needs Master Disk)

The Crystal Planet - You will have to embark on this final portion of your expedition ignorant of what you may encounter here on this mysterious planet, excepting that the 7th world holds the ultimate key to winning the contest. **$29.95** (needs Master Disk)

The Contest — To the Winner with the highest score, who solves the mystery by November of 1982 will go $5000.00 in cash. Good Luck!

★ ★ ★ ★ ★ ★

GLAMIS GASTLE — According to ancient legend and records this castle is one of the most haunted sites in Great Britain. One Lady Glamis, known to be in league with the devil, liked to send out a destructive demon to harrass the townspeople. She finally was burnt at the stake on Castle Hill, cursing as she died all future generations of the Lyon family. Her demon still seems to haunt that spot, murdering the curious who stray up to Castle Hill after dark. The curse stipulated that each succeeding generation would have at least one child, often female, who would be a vampire. When an heir comes of age, there is a secret ceremony in which the heir, his father, and the steward take crowbars and chip away plaster concealing a hidden chamber, known only to them, that Earl Patie used when he gambled with the devil. Another tradition says that a creature, half-man, half-beast stalks the passages in the walls of Glamis to insure the fulfilling of the curse. The mystery, of course, is to determine the location of this secret chamber. Our game, occupying 2 disks, will have as exact a replica of the castle as possible. It's definitely one of a kind! And we will be offering a $500 prize to the first person daring enough to solve the centuries-old mystery of Glamis Castle. **$49.95 2 disks.**

Crystal has many other fine fantasy and space games. For a copy of CRYSTAL VISION which includes a complete catalog please send $3.00 to the address below.

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master charge

VISA

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put...input/output...inp

Even Tighter

Dear Editor:

I enjoyed Robert A. Howell's article, "RAM Cram Techniques for Atari" in the August issue.

I offer the following further reductions of bytes used in his programming examples. Most of them take advantage of the fact that a true logical statement is evaluated as a +1 while a false statement is evaluated as a 0.

Example 1:

```
100 SUM=0: FOR I=1 TO 10:IF
A(I)>0 THEN SUM=SUM+A(I)
130 NEXT I:PRINT SUM
```

reduces to:

```
100 SUM=0:FOR I=1 TO 10:SUM
=SUM+A(I)*(A(I)>0):NEXT I:
PRINT SUM
```

for a saving of three bytes.

Example 2:

```
100 X=10:IF L=R THEN X=20
200 GOTO 1000
```

reduces to:

```
100 X= 10+(L=R)*10:GOTO 1000
```

for a saving of 17 bytes.

Example 3:

```
100 IF NOT(A=1 AND B>5)THEN
B=B-1:GOTO 1000
130 PRINT
```

reduces to:

```
100 IF A<>1 OR B<=5 THEN B=B-1:
GOTO 1000
130 PRINT
```

for a saving of three bytes.

Example 4:

```
100 IF A<>1 OR B<=5 THEN B=B-1
```

if it appeared by itself (not as in example 3 above) could reduce to:

```
100 B=B-(A<>1 OR B<=5)
```

or alternately:

```
100 B=B-(A-1 OR B<=5)
```

for a saving of eight bytes.

Example 5:

My favorite reduction in the article involved reversing the values of 0 and 1. The author began with:

```
10 IF B=0 THEN B=1:GOTO 30
20 B=0
```

which was reduced to:

```
10 B=ABS(B-1)
```

but what about:

```
10 B=1-B
```

Example 6:

This last example doesn't involve a reduction in bytes but it takes advantage of a reduction suggested by Mr. Howell and speeds up the execution time quite a bit. He suggested the following to set R$ equal to a string of 100 "N"s.

```
100 FOR I= 1 TO 100:R$(I,I)="N":NEXT I
```

A much faster alternative (even if it does take up an extra three bytes!):

```
100 R$(1)="N":R$(100)="N":R$(2)=R$
```

David H. Press
21 Jefferson Avenue
Hastings-on-Hudson, NY 10706

"According to my calculations, it should hit the Earth in .00298 seconds."

Dungeon Drudgery

Dear Editor:

I am a long time aficionado of both computers and Dungeons and Dragons. I am looking for software to help automate the job of the Dungeon Master.

I adventure with a group which is growing all the time, and we need help. If we cannot find aids for our pet Dungeon Master, we may have to install an associate DM, or limit the number of players in the adventure. Neither solution is desirable since everyone wants to play as an adventurer, and the group is always happy to make new friends.

Please, *Creative Computing* readers, if you have some software, let me know! I'm being held captive in a black-hearted dragon's lair by a diabolical siren until I am rescued by a purveyor of software.

Brutus Lorewise
Ranger Knight
2220 Sims Drive
Columbus, IN 47201

Feeding Time

Dear Editor:

The following is a procedure for a do-it-yourself sheet-feeder. I'm using it with an MX-80, but I expect it would work with other pin-feed printers. It has the ability to print closer to the top of the page than other sheet-feeders, requires absolutely no modification to the printer, and costs about 3 cents and 5 minutes.

What we are doing is building a carrier, which can then be loaded with any type of paper: bond (without little perf-strip fuzzies), letterhead, what have you. Step by step:

1. Run out two connected sheets of fanfold paper. Leave the sprocket strips attached. Double-weight paper seems to work better, but anything will do.

2. Cut off a strip an inch or so wide from the bottom (or top).

3. Apply glue (watered Elmers spreads nicely) to one side of this strip, except for a half-inch strip along one long edge. I used a piece of slightly-used (for easier removal) masking tape to give a sharp edge.

4. Apply the little piece of paper to the big piece of paper, lining up the sprocket holes, with the top edge of the strip about 3-4 inches from the top of the truncated double sheet, the unglued flap toward the bottom.

5. Go have a beer to celebrate completion.

To use, simply slide the top edge of a single sheet of paper under the flap (this is done most easily by coming in from the side and sliding the sheet across the carrier), line up the edge with the perforation lines, load normally into the printer (turned off), and go. The lead flap of the carrier allows for easy positioning even to nearly the top of the sheet; the trailing end keeps the out-of-paper signal stifled.

I suppose someone could market a permanent version of this, using a miracle plastic and high technology, but I think it would be like counterfeiting pennies; hardly worth the effort. The home version isn't real handy for production work (by the way, it is easier if you slip the paper separator off), but it's worth its cost.

Philip B. Sturmfels
510 Yeatman
St. Louis, MO 63119

The Lines They Are A-changin'

Dear Editor:

In response to Mr. E.B. Buchanan's letter in the October issue of *Creative Computing*, referring to the bug in the Applesoft Renumber program:

There is a simple fix:

If your line 100 (in your example) reads:

```
100 A=INT(A*100+.5)/100,
```

And, when line 100 is renumbered to 136 reads:

```
136 A=INT(A*136+.5)100,
```

Always, when entering lines in this form, put the integer *before* the asterisk. In your example:

```
100 A=INT(100*A+.5) [Change 100 and A]
```

will renumber properly.

For some reason, if the integer corresponds to a line number which is being changed, Renumber changes the integer. If the integer doesn't equal a line number, Renumber leaves it alone.

This has worked for me, and now that I'm used to formulae in this form, the program is more readable.

Chuck Lawhorn
9554 Muirkirk Rd. #102
Laurel, MD 20708

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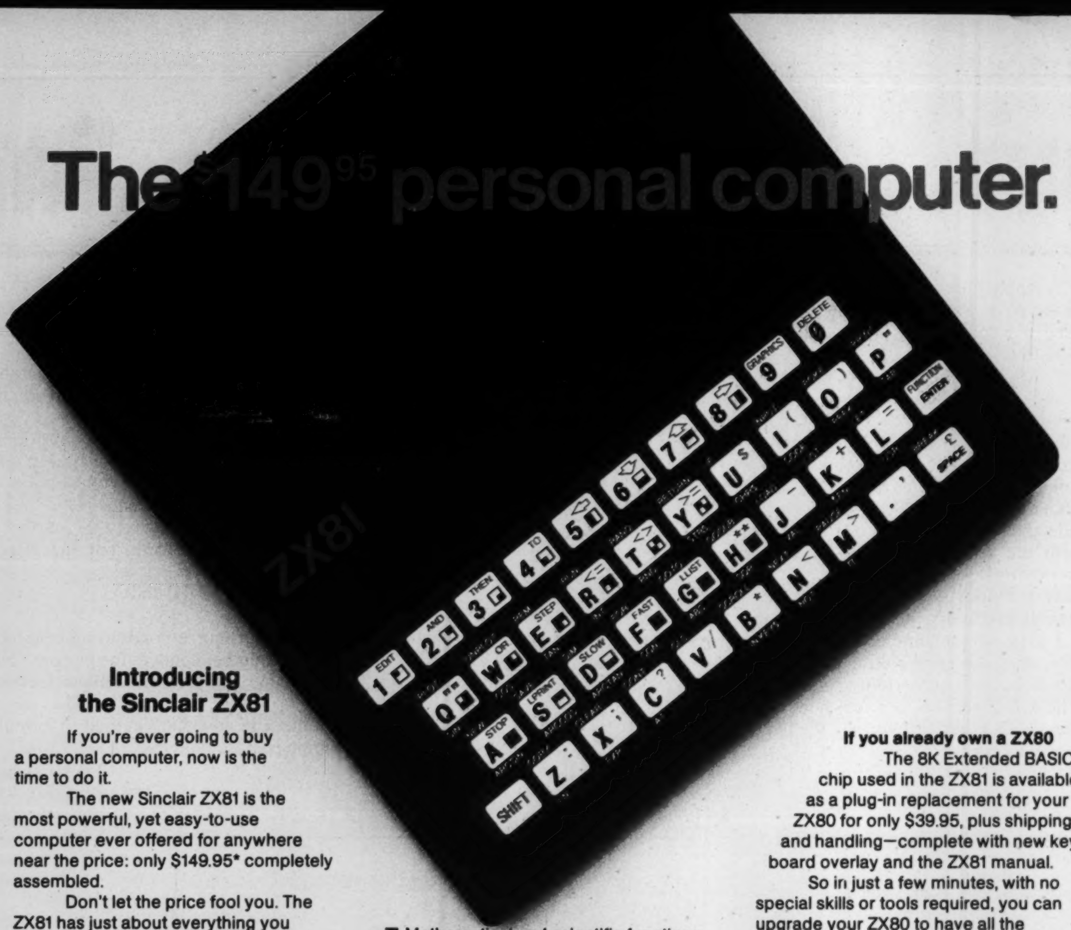

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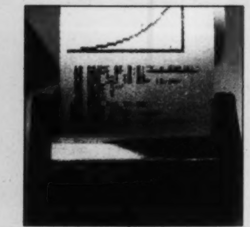

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You live in a small town in the 14th century. You were awakened this morning by a terrible pain in your arm. Upon examining your arm, you find a bloody gash in it. Wisely you cover it so that nobody will see it. Later, you find that the townspeople had seen a werewolf last night and one person had shot an arrow at it, but evidently he had missed, because the werewolf continued running. You instantly deduce that you must have been the werewolf and realize that you must find an antidote.

You decide to go to a nearby dungeon that is deserted. Legend says that a powerful wizard, Evro, once lived there, but he became a victim of his own experiments. The rumor is that he had strange and deadly creatures under his power. You decide that you might be able to find some sort of recipe for a potion to cure your affliction.

Unfortunately, it is right around the time of the full moon, and you know that you will almost certainly become a werewolf tonight again. In fact, the moon rises tonight at exactly midnight, which has always had a mystical aura about it. You arm yourself with a fine sword and a full lantern and set off in search of the dungeon. After finding the ruins which used to be Evro's castle you look for some sort of entrance, such as a stairway.

While searching, the ground suddenly gives way under you. Breathing heavily, and trembling with fear. . .
PRESS (RETURN) TO CONTINUE

creative
computing
equipment
evaluation

the IBM personal computer

Will Fastie

As I stepped from my car into the South Florida swelter, a wave of apprehension swept over me. Betsy had worked hard to get early delivery on an evaluation unit. She was politely, but firmly, refused.

I had arranged to work in the Baltimore office on their machine. Those plans were politely, but firmly cancelled. We shared our frustration: didn't these people understand the small computer market, and didn't they want the world to know about theirs?

Now I stood in front of the Entry Systems Business Division (ESB) of the Information Systems Division (ISD) of International Business Machines Corporation (IBM) in Boca Raton, FL, home of the IBM Personal Computer. I wondered if my time inside would prove as difficult as the negotiations that led me here.

As I entered the contemporary but unremarkable building, a wave of comforting cool air swept over me. It was but the first of many pleasant experiences I would have in the next two days. I politely, but firmly, announced myself.

> ***IBM has overcome the burden of their tradition while using that tradition to their best advantage.***

I was met by Jeannette Maher from the Public Relations department, with whom I had arranged my visit. She escorted me into an area that looked like IBM's conception of the ideal retail environment in which to market their new Personal Computer. We walked through a tastefully decorated lobby area and through smoked glass doors set into a wall of smoked glass. Inside we passed IBM's show display wall, and there they were. Three IBM Personal Computers sat on three modular display stations. A little voice inside me screamed "Be *objective*!" and I started to drool.

Inside this quiet room I was looking at what, to me, represents a revolution in small computers. IBM is entering a market that is just passing out of adolescence, but is well-established. This is both a disadvantage and an advantage for them. The problem is that they have built a machine which is vastly different and for which very little support can be found in the general market.

W. H. Fastie, 7110 Sheffield Rd., Baltimore, MD 21212.

The advantage, of course, is that they have the experience of others from which to learn and can "do it right." I think they have done it exactly right, some disappointment notwithstanding. And to have done it right means that IBM has overcome the burden of their tradition while using that tradition to their best advantage. IBM considers this a breakthrough because they have depended on outside sources for software, and because of the new ways in which they will support their software.

Why is this a revolution? The IBM Personal Computer is the first in the second generation of small systems. It uses the Intel 8088 CPU, a 16-bit, single-chip processor which, besides being intrinsically more powerful than the common 8-bit machines, allows the incorporation of up to one million bytes of main memory. IBM designed for the entire address space and announced expansion to and support for up to 256,000 bytes of main memory. The design of the Personal Computer allows it to span the entire market for small computers from the home consumer through the small business to the large, so-called "Fortune 1000" companies. No other small system offers this breadth of market satisfaction as well as an extraordinary combination of price, performance, feature, and function.

Overall System Description

The computer has been designed with an eye for aesthetics without sacrificing practicality. Each of the four major components is clothed in subtle tones of beige and eggshell white; these colors allow the system to blend into any environment.

The display is one of the sharpest, clearest, most attractive I have ever seen.

The system unit, which houses the electronics and the diskette drives, is 16" deep, 20" wide, and 6" high. There is a bezel on the front which makes an otherwise boxy look. The edges are softly rounded and the top is perfectly flat to accommodate a display device. The on/off switch is large and red, and is located at the far rear edge on the right side, out of accidental reach.

All cables connect to the rear of the unit. The detachable AC power cord plugs into a male receptacle on the left side (as viewed from the rear). There is a female receptacle next to that which is intended as a power connection for a display device and which is controlled by the main power switch. Also on the left is an air vent through which air is exhausted from the power supply. On the right are the spaces through which connectors from the various controllers protrude. There is a cassette recorder connector on the back. Space is provided for two single sided, double density, 5 1/4" diskette drives, each of 160,000 byte capacity.

The IBM Monochrome Display is the only display device available from IBM. It is 14" deep, 15" wide, and 11" tall. It is supplied with a power cable. The housing stands on four rubber feet, and its styling is reminiscent of the IBM 3101 ASCII terminal. Two controls, for brightness and contrast, are mounted near the lower right corner of the 11.5" diagonal CRT.

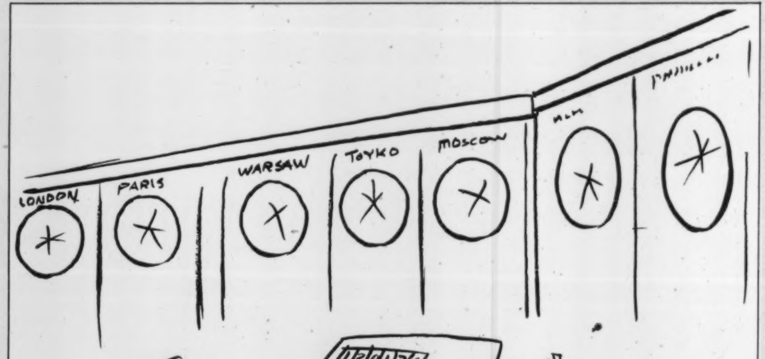
The display uses a high persistence green phosphor and generates 7 x 9 dot characters in a 9 x 14 dot box. Upper and lower case letters can be displayed as well as foreign language characters, line drawing characters, clock characters, and others; these contribute to a character set that includes over 240 displayable characters. Lower case descenders are provided. Display attributes supported are blink, reverse video, double intensity, non-display, and underline.

However, this dry commentary doesn't do justice to the display, which is one of the sharpest, clearest, most attractive I have even seen. The combination of the 7 x 9 characters and the high persistence phosphor creates characters in which the invididual dots cannot be seen and the letters appear to be fully formed.

IBM scores another point for the keyboard, easily the best among personal computers. It is 20" long (matching the width of the system unit), 8" deep, and 2.5" high. This last figure is somewhat misleading, since the keyboard can be adjusted to two angles. With its rear legs extended it is 2.5" high, but with the legs retracted it is not much more than 1" high.

The keyboard is attached to the system unit with a 6' coiled cable. It has 83 keys and includes a numeric keypad which doubles as a cursor control pad. IBM chose to make the cursor control keys the default, but wisely added a key which locks the keypad into numeric mode. A CAPS lock key makes the letter keys generate capitals.

Ten programmable function keys are placed in two columns of five to the left of the main key area. Like most standard keyboards, the shift and control keys generate additional codes. However, the combination of shift and control is not provided. Instead, the ALT key provides a fourth



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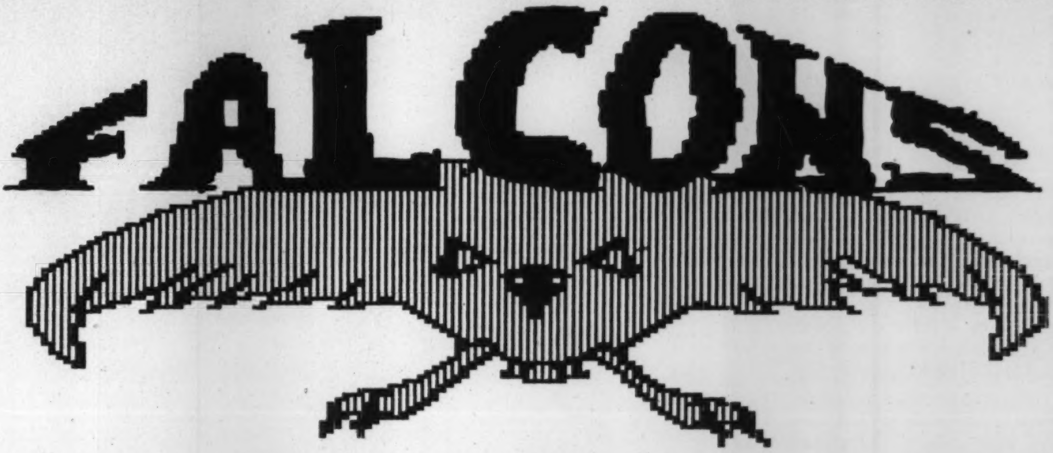

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code for each key. The "Typamatic" feature is included—each key can be held down and will automatically repeat. Depressing the ALT-CTRL-DEL keys simultaneously causes the system to initiate its power-on sequence.

The keyboard has an excellent feel. The rows of keys are angled and the keytops are slightly dished. The main keyboard is eggshell white while the control keys are beige. The keys make an audible click and provide good tactile feedback as well.

But the keyboard, nice as it is, is the source of both my first disappointment and a terrible flaw. The disappointment is the ten function keys, which I think would be better placed in a single row across the top of the keyboard, especially because IBM has provided a "softkey" display option at the bottom of the display device. I could better accept the position they are in if there was room to fit a descriptive template around them. As I say, a mild disappointment.

The flaw is the backslash key, which is placed between the left shift key and the Z key, right where the shift key is supposed to be! No kidding—look at your typewriter or keyboard. I had an awful time shifting. When I meant to type "P..." I would invariably end up with "/p..." and have to back up. I started asking everyone in sight what they thought and they all said they had quickly adapted to the arrangement. That's my point exactly: no adaptation should have been required. /oh well, /i guess /i'll adapt....

The only printer IBM offers with the Personal Computer is the Epson MX-80 in IBM colors. It is equipped with a standard Centronics parallel interface. I asked if I could attach an Epson MX-100 and the answer was yes. This printer should be well known to most of you by now (see *Creative Computing*, July 1981, page 66), so I'll only mention that it is the basic MX-80 without the graphics or F/T options, and that it does not print the entire character set that the display device can generate. The twelve "type styles" to which IBM refers are various combinations of double strike, emphasis, and character spacing and are not different fonts.

The System Unit

A point of contention between *Creative* and IBM prior to my visit to Boca Raton was that IBM would not allow the cover to be removed from the unit until after the first customer shipment in October. I was delighted to receive permission to take my peek on the grounds that this article would be published after the machine was in the hands of the public. I can therefore tell you that inside the system unit there are a bunch of green cards full of little black things with lots of silver legs.

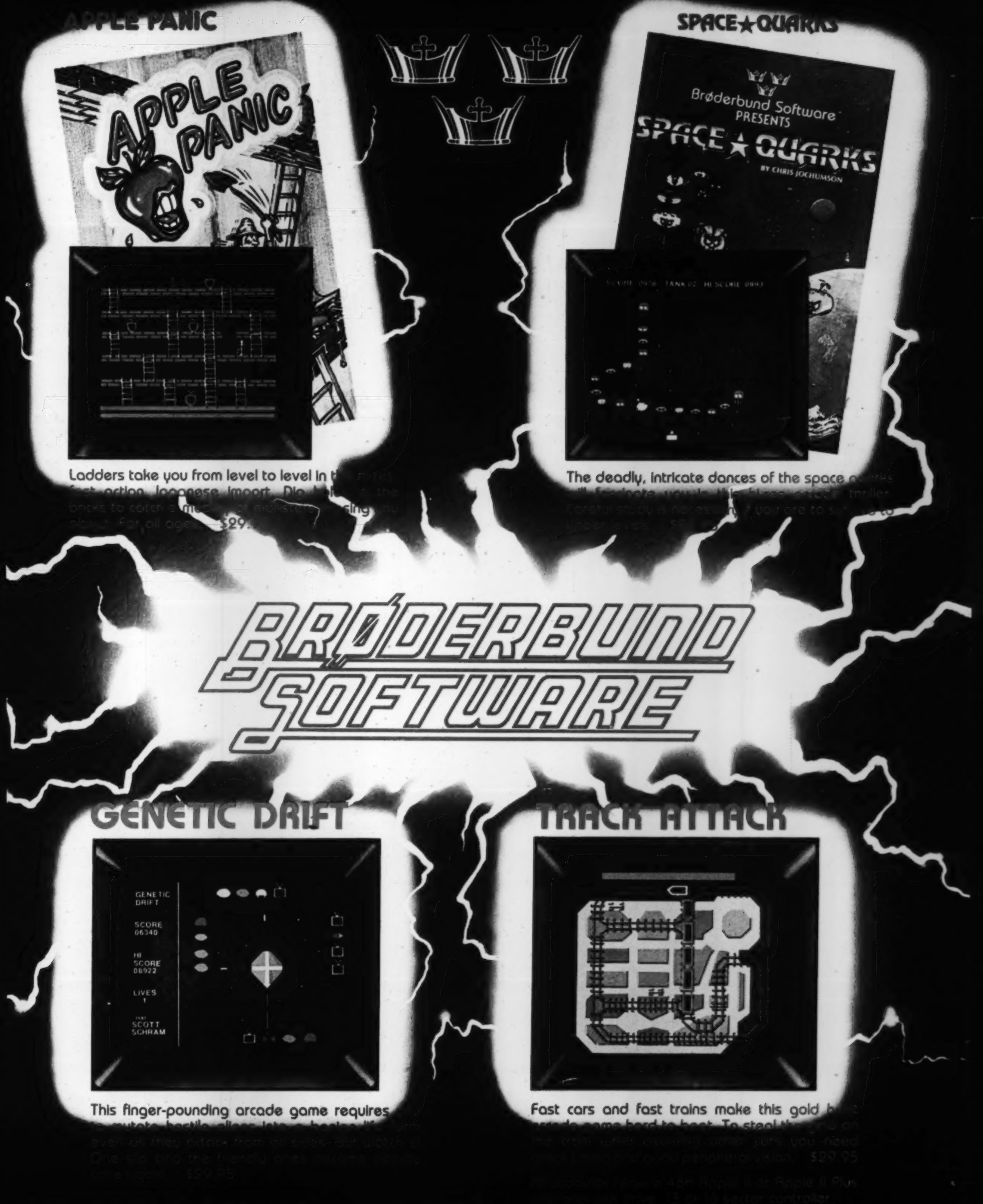
The system unit *sans* cover is surprisingly compact. Viewed from the top, the power supply occupies about an eighth of the space in the rear right corner. It is completely enclosed in steel, with an intake fan mounted directly under the top. I had not seen a fuse from the outside and none was in evidence inside; the power supply has an internal circuit breaker which resets automatically after about ten seconds.

The system unit sans cover is surprisingly compact.

The two diskette drives are mounted in the front of the cabinet and extend to within an inch of the power supply. Together, both drives and power supply take up about 2/3 of the space inside. A small speaker is mounted on the left side of the chassis near the front, and is connected to the main board with a plug.

The CPU card is mounted flat on the bottom of the chassis and extends from front to back on the left side. One corner of the board is hidden under the diskette drives. To the rear are five slot connectors into which adapter cards for the various peripherals are inserted. The slots are numbered 1 to 5 from left to right, and line up directly with five holes cut into the rear of the chassis. If the slot has no card inserted, the rear panel hole for that slot is covered with a small metal cover which is attached with a screw to the rear panel. This cover is discarded for slots to be filled, since each card is permanently attached to such a cover, through which the necessary external connectors protrude. With the card inserted and the cover screwed down, the card is held rigidly in place. The IBM designers have solved three problems in one with this clever scheme: the rear panel is clean, and completely sealed; the external connectors are firmly mounted and supported; and the adapter cards are appropriately secured.

Even though all slots are created equal electronically, allowing any adapter card to be used in any slot, IBM recommends that the display adapter card be inserted in slot 2. It turns out that display cards are as long as cards can be in the system unit, and that slot 2 is equipped with a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special plastic guide to prevent the long cards from wobbling. In response to my question "Why not guides for all the slots?" IBM replied that it represented an additional manufacturing process. Each slot has the holes that support the guides, so the guide in slot 2 can be moved and additional guides could be added.

The Intel 8088 CPU is placed in a socket on the right rear corner of the board. Right next to it is an empty 40-pin socket. IBM in Boca Raton "refused to speculate" about the purpose of the socket but two other sources within IBM stated that it was for future inclusion of an Intel 8087 floating point processor (see box). The CPU board also contains 40K (kilobytes) of ROM (read only memory) in five sockets, 16K of RAM (random access memory) soldered to the board, and sockets for an additional 48K of RAM. Memory beyond 64K is added with 32K or 64K memory cards which occupy system expansion slots.

There is a set of DIP (dual inline package) switches which is used to tell the CPU how many diskette units are installed, among other things. A crystal on the CPU card generates a frequency of 14.31Mhz which is divided by 3 to get a 4.77Mhz clock for the CPU, by 4 to get a 3.57Mhz clock to drive television sets, and by 1 to drive direct drive monitors.

I'm not an engineer, but to my eye, all the boards seemed well constructed. There seemed to be good separation between components and between tracks. The adapter card slots were well-spaced so cards should not touch and air circulation should not be impeded. The chassis and the cover are both steel and the entire unit is well sealed. The system has received FCC Class B certification for home computers and is UL approved.

Imagine my surprise when Basic announced it had 61404 bytes free!

The 40K of ROM that comes with every system unit contains three software elements. Two kilobytes are devoted to diagnostics which perform comprehensive tests of the entire system, including memory, whenever the system is turned on or the ALT-CTRL-DEL key combination is depressed. IBM's Basic Input/Output System (BIOS), which provides control for all devices except diskette drives, occupies 6K. The remaining 32K is a Basic language interpreter which IBM calls Cassette Basic and which is automatically started if there is not a disk in the diskette drive or if there is no diskette drive.

Basic

IBM contracted with Microsoft to provide the Basic interpreter for the Personal Computer. The version in ROM is essentially Microsoft Basic-80, version 5.x, without the statements associated with disk file access. To the best of my knowledge, it is the most extensive Basic offered in any personal computer ROM. It is certainly large; most small computers are usually delivered with 16K of ROM containing Basic and a small monitor.

What's an 8088 and What's It Doing Inside My IBM Computer?

The 8088 is a member of a family of single chip processors manufactured by Intel Corporation. The 8088, and its big brother the 8086, are processors with a 16-bit internal architecture which provides 16-bit wide registers, data paths, ALU (arithmetic/logic unit), and instructions. The 8088 and 8086 differ only in that the 8088 has an 8-bit external bus interface while the 8086 implements a full 16-bit interface. The 8-bit bus is very similar to that used in other Intel 8-bit machines, such as the 8085A, and is relatively simple to design and build.

The performance of the 8087 is spectacular.

There are two features of the 8088 processor that are extremely important. The first is its ability to address one megabyte of main memory, and the other is the "pipeline" architecture, or "prefetch" processor.

IBM has used the full one megabyte address space in the Personal Computer. The ROM is physically located at the top of the megabyte. Display adapter memory is located somewhere around the .75 megabyte boundary. Main memory starts at location 0 and includes the interrupt vector tables; available user main memory begins a few hundred bytes later. It should be obvious that this memory scheme allows for tremendous expansion and growth, not only for main memory, but for ROM and display memory as well. Eight color graphics could be obtained, for example, by doubling the memory of the Color Graphics Adapter. The same change allows four colors for high resolution graphics and doubles the resolution for black and white graphics!

The pipeline architecture allows the next instruction to be obtained from memory while the current instruction is executing. This means that the instruction processor typically does not need to wait for its next instruction and therefore has a higher effective performance. Although the 8088 is an 8-bit machine to the external world, the prefetch processing can accelerate the machine well beyond what is possible on current 8-bit machines.

There are two other members of the 8086 family. One is the 8089 I/O Processor, which is a high speed, two channel I/O controller. It behaves more or less like data channels on IBM's larger systems. The other member, far more interesting to the IBM Personal Computer owner, is the 8087 Numeric Data Processor. This chip is actually a "co-processor" which extends either the 8088 or 8086 instruction set to include arithmetic and logical operations on seven different data types, and also provides built-in transcendental functions. Adding the 8087 to 8086/8 system is transparent; the perceived result is an 8086/8 whose capabilities have been greatly expanded.

The performance of the 8087 is spectacular. Intel, in the July 1980 issue of the 8086 Family User's Manual Numerics Supplement, compares 8087 executions against 8086 software emulations of the same functions. An example, square root, performs in 19600 microseconds in 8086 and an astounding 36 microseconds with the 8087, a 54,000% improvement! Other functions are similarly fast.

The point of this discussion is that the IBM Personal Computer will become a very formidable scientific processsor when the 8087 is made available for it, and that the other applications such as VisiCalc, will be significantly accelerated.

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The systems I used for my evaluation all had 64K of RAM installed. Imagine my surprise when Basic announced it had 61404 bytes free! In effect, I was working with a 104K system.

But Casssette Basic is not the end of the story. Two other versions of Basic are available for systems which include one or more diskette drives and for which the Personal Computer Disk Operating System (DOS) has been purchased. Disk Basic adds the disk file statements and makes the Basic equivalent to Basic-80. Advanced Basic adds advanced graphics, music, and some special extensions for event trapping that allow real-time programs to be written using Basic! Best of all, these Basic extensions are just that—extensions.

The kernel Basic interpreter in ROM is still used and the only memory used by the extension is that which they themselves need. Table 1 shows the sizes of the three Basic systems and the amount of user memory they leave available in a 64K system. If the main memory in the system is extended to 96K or more, all versions of Basic will have a maximum of about 60K of available user memory.

There are several special features of the IBM Personal Computer Basic. A very good full screen editor is provided and behaves intuitively. (By this I mean that depression of the cursor control and editing keys produces a logical and expected effect.) Basic is able to handle communications at speeds up to 9600 bits/second. The ALT key in conjunction with the letter keys can be used to automatically generate Basic keyboards, speeding entry of programs. Finally, both Disk and Advanced Basic are memory resident and do not require a disk once loaded.

Table 1. Basic System Memory Utilization—64K Systems

(Memory figures are given in kilobytes)

Basic Version	Incremental Memory	Total Memory Required	Memory IBM	Available Observed
Cassette	–	4.0	60.0	61.404
Disk Basic				
DOS	12.0			
Disk Basic	8.0			
Total	20.0	24.0	40.0	41.156
Advanced Basic	5.0	29.0	35.0	35.707

Note: In all versions, a maximum 64K workspace is supported, of which about 4K is required for interpreter overhead.

Table 2. Defined System Characteristics of the IBM Personal Computer Basic

Characteristic	Implementation	Verified*
Name length	Unlimited (40 significant)	
Integer arithmetic	yes	x
Multi-statement functions	no	
Function Recursion	yes	x
Multi-statement lines	yes	x
Syntax checking	when RUN	x
String arrays	yes, 256 characters deep	
Messages	full phrase	x
Statement numbers	0 to 65535	
Dimension default	11 elements	x
Float precision, number of digits	7 single; 17 double	
Float exponent	± 38	
Float size, bytes	4 single; 8 double	
RENUM command	yes	x
Nested IF	yes	x
Max subroutine depth	none	
Link to machine language	yes	
Formatted output (PRING USING)	yes	x
Max number array dimensions	255	
Break procedure	CRTL-Break	x
Number of string functions	13	x
PEEK/POKE	yes	x
CHAINing and COMMON	yes	
Error trapping	yes	x
Random I/O	yes	
Limit of nested loops	none	
Number of keywords	158	
Trace features	yes	x

*Verified means Will saw it.

The December 1980 issue of *Creative Computing* features a comparative evaluation of Basics (page 70). Table 2 lists the same "defined system characteristics" for the IBM system.

I do have one complaint about the three Basics. The DATE$ and TIME$ are not in Cassette Basic but become available in Disk Basic. These are relatively simple features, and are useful even in minimal systems. I feel somewhat the same way about the advanced graphics and music functions. These features are very useful in entertainment programs, which are most likely to run on smaller configurations. Expanding a minimal system to include Advanced Basic requires an upgrade to 48K of memory ($180), one diskette drive ($790), and DOS ($40). For the consumer who has invested $1600 in a machine with limited third-party software support, $1090 is a significant next step.

IBM has seen to a competent and powerful implementation of Basic. The availability of almost all of Basic-80 in ROM is a strong feature. The amount of available memory is a close second.

Table 3 shows which Basic statements are included with each version of the IBM Personal Computer Basic.

Graphics

Perhaps the most exciting feature of the IBM Personal Computer is its graphics capability. This is one place where IBM has learned their lesson well and where the price, performance, function, and feature considerations become evident.

The IBM Monochrome Display has already been described. This display device does not support graphics—it is for text only. To get at the graphics features of the machine a Color Graphics Adapter card must be installed in a system slot. This adapter allows color monitors, black and white monitors, and televisions to be connected. Television sets also require an RF modulator, which IBM does not supply. The adapter can also drive several monitors on TVs at once, in any combination.

The adapter comes with its own 16K of memory to store display information. (The Monochrome Display adapter supplies 4K to store display text.) This is absolutely terrific, because it means that even with the highest resolution graphics *no program memory is used* to store screen data! It also means that the $1595 minimal con-

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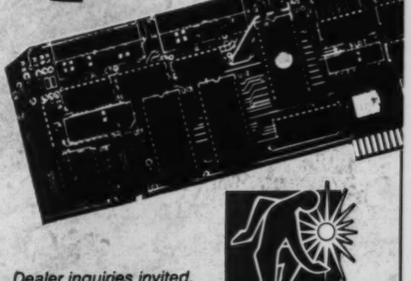

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Cassette Basic

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ATN
AUTO
BEEP
BLOAD
BSAVE
CALL
CDBL
CHR$
CINT
CLEAR
CLOSE
CLS
COLOR
CONT
COS
CSNG
CSRLIN
DATA
DEF FN
DEFINT
DEFSNG
DEFDBL
DEFSTR
DEF USR
DELETE
DIM
EDIT
END
EOF
ERASE
ERR, ERL
ERROR
EXP
FIX
FOR, NEXT
FRE
GOSUB
GOTO
HEX$
IF..THEN..ELSE
INKEY$
INP
INPUT
INPUT#
INPUT$
INSTR
INT
KEY
LEFT$
LEN
LET
LINE
LINE INPUT
LINE INPUT#
LIST
LLIST
LOAD
LOCATE
LOG
LPOS
LPRINT [USING]
MERGE
MID$
MOTOR
NEW
OCT$
ON ERROR
ON..GOSUB
ON..GOTO
OPEN
OPTION BASE
OUT
PEEK
PEN
POINT
POKE
POS
PRINT [USING]
PRINT# [USING]
PSET
PRESET
RANDOMIZE
READ
REM
RENUM
RESTORE
RESUME
RETURN
RIGHT$
RND
RUN
SAVE
SCREEN
SGN
SIN
SOUND
SPACE$
SPC
SQR
STICK
STOP
STR$
STRIG
STRING$
SWAP
TAB
TAN
TRON, TROFF
USR
VAL
VARPTR
WAIT
WHILE..WEND
WIDTH
WRITE
WRITE#

Statements added by Disk Basic

CHAIN
COMMON
CVI
CVS
CVD
DATE$
FIELD
FILES
GET (files)
KILL
LOC
LOF
LSET, RSET
MKI$
MKS$
MKD$
NAME
OPEN "COM...
PUT (files)
RESET
SYSTEM
TIME$

Statements added by Advanced Basic

CIRCLE
COM
DRAW
GET (graphics)
KEY (n)
ON COM
ON KEY
ON PEN
ON STRIG
PAINT
PEN STOP
PLAY
PUT (graphics)
RETURN line
STRING (n)

Table 3. Basic Statements

sumer configuration of a system unit and color graphics card actually provides 32K of memory—16K for program and an independent 16K for the display—and is eminently useable. And yes, in Basic you are still left with the available memory shown in Table 1. The adapter will also support a light pen, although IBM does not make one available, and light pen statements are included in Basic.

The adapter supports two text modes and two graphics modes. The text modes have resolutions of 25 lines of either 40 or 80 characters. There are 16 foreground and eight background colors. These modes can either be used for text or for block graphics, using the characters in the display set Incidentally, the same character set is supported on both the Monochrome Display and the Color Graphics Adapter, so software does not need to know the difference.

The medium resolution graphics mode uses 200 dots vertically and 320 dots horizontally, and four colors can be displayed. Other colors may be created by plotting dots of different colors next to one another.

The high resolution graphics mode uses 200 dots vertically and 640 dots horizontally, and is limited to black and white. The adapter allows horizontal text to be interspersed with graphics; PRINT statements from Basic output the text, and no special control or character generation is required from the software. In graphics mode, the character set is limited to 128 characters, which can be user-defined. The characters are 7 x 7 dots in an 8 x 8 box, with a single line of pixels for descenders. All display attributes of the Monochrome Display, except underline, are supported.

Even with the highest resolution graphics no program memory is used to store screen data!

On a monitor, the adapter easily displays 80-character lines. On a television set, overscan will probably cause information on both the left and the right to be lost. The Color Graphics Adapter can be told to shift the display to overcome the problem, if only on one side. On some TVs it may be possible to see the entire 80 columns; on most, this is unlikely.

In text mode the adapter can support multiple pages of text. If the display mode is 25 x 40, four pages can be stored, and in 25 x 80, two pages are stored. An "active" and "visual" page can be specified. The visual page is the one which the display hardware uses. The active page is the one written to with, for example, PRINT statements in Basic. Basic allows full control of this feature, which can be used to switch rapidly between screens of text or to animate using character graphics.

Cassette Basic provides a complete, if not elaborate, set of statements that allow access to the color graphics features. The COLOR statement is used to select the colors that will be displayed. The LINE statement can be used to draw a line from any point to any other point on the screen,

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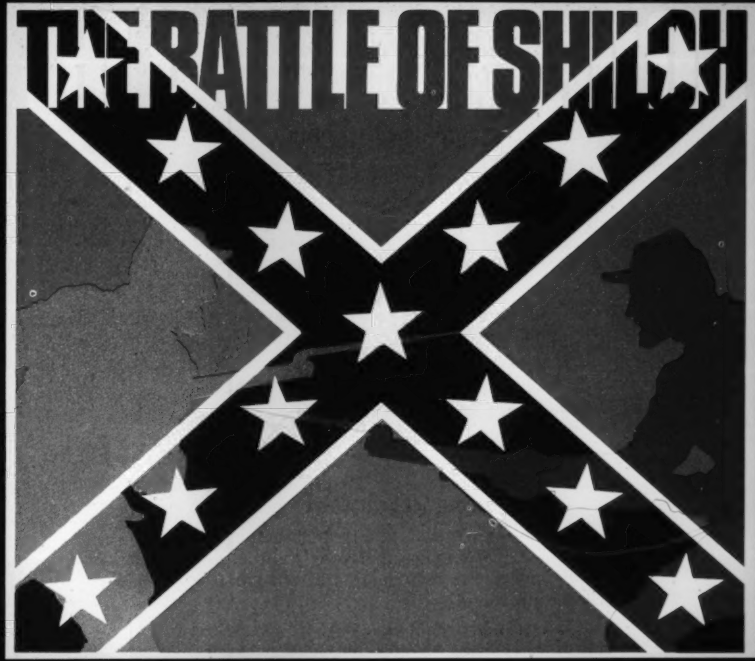

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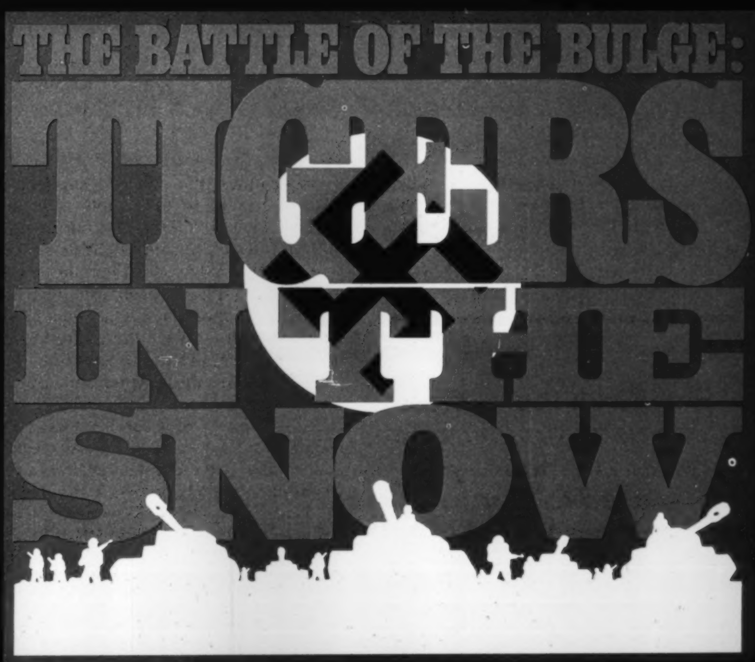
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to draw any rectangle, and to fill any rectangle with solid color. PSET and PRESET are used to set or erase any point on the display. The SCREEN statement selects the graphics mode.

Advanced Basic has very powerful graphics capabilities. The CIRCLE statement draws any circle, ellipse or arc, and can also connect the ends of arcs to the center point, a kind of automatic pie-chart feature. The DRAW statement interprets a character string for commands which can be used to build arbitrary shapes. PAINT fills a space with a specified color in all directions, and stops only when blocked by another color. The most powerful commands, however, are GET and PUT. GET is used to read a section of the screen memory into a Basic array. PUT works in the other direction, transferring the array to screen memory.

With a little help, I wrote a graphics program in Advanced Basic that animated a ball. I didn't have time for anything elaborate, so I just made it move across the center of the screen from left to right.

First, I used CIRCLE to draw the ball, and PAINT to fill it with another color. Then I used GET to retrieve the bit pattern I had drawn from the screen memory. After clearing the screen, I was able to PUT the ball anywhere I wanted to. PUT is also used to erase the object. My program consisted of a short loop which PUT the ball, paused, PUT the ball again to erase it, and advanced by some fixed step to the right. It took me 10 minutes to write this program. I could just as easily have used the DRAW command to build an arbitrarily complex shape, and moved it around. By the way, when I ran my ball program with 15 steps across the screen the ball got from left to right in about a second.

IBM has written a set of demonstration programs which will be available to their dealer network. Some of these programs demonstrate the graphics capabilities very effectively. But here's the shocker—the programs are written in Basic!

Table 4 shows how the IBM Personal Computer stacks up with other personal computers having color graphics capability. I think the Atari 800, with its graphics

The IBM Personal Computer VisiCalc Machine

A new computer in today's market finds itself in great difficulty if there is little or no software available for it. The IBM Personal Computer surely falls into this category. The few packages available through IBM cannot compare to the volume of software currently available for CP/M-based systems, for example. Given this circumstance, how does IBM plan to sell a significant number of machines before the software base is established?

Everyone, from accountant to the Information Systems VP will feel warm and comfortable with a computer bearing the same logo as the big blue monster in its lair downstairs.

I believe the answer lies with VisiCalc and in the three letters I-B-M. IBM is firmly entrenched in the world's largest corporations with its line of mainframe systems. These clients of IBM's Data Processing Division (DPD) are prime targets for an aggressive marketing effort. The DPD salesman can offer a large firm an independently programmable computer (distributed processing), an IBM compatible terminal (a 3270 emulator is a stated IBM "intention"), and the big gun, VisiCalc.

Assuming IBM and Software Arts remove the current memory limitation of VisiCalc, and there is really no reason to think that problem won't be solved, the DPD salesman can overcome the two traditional obstacles to distributed small computers: name (identity) and capacity. Everyone, from accountant to the Information Systems VP will feel warm and comfortable with a computer bearing the same logo as the big blue monster in its lair downstairs. VisiCalc, with available memory limited only by the amount installed, can deal with even the largest and most complex spreadsheets and models that financial planners and analysts require. Calling the monster by using the Personal Computer as a 3270 and writing local programs are just so much icing on the cake.

The IBM Personal Computer is also aggressively priced for this function. The chart below lists several popular VisiCalc implementations and shows the capacities and costs of each. The IBM machine is, again, not the cheapest, but it does have the best price/function ratio. Try dividing the total system price by the number of VisiCalc entries—it's an interesting exercise.

The VisiCalc machine theory is further supported by the fact that IBM has organized an independent sales organization within DPD specifically to market the Personal Computer in this business segment. Companies ordering fewer than 20 units will be referred to the local authorized IBM dealer. DPD will handle orders for 20 or more units meeting certain minimum configuration requirements, and will offer volume discounts as follows:

Number of Units	Discount
1 - 19	0%
20 - 49	5%
50 - 149	10%
150+	15%

Comparison of VisiCalc Machines

All systems shown include CPU, maximum memory (128K for Apple III and IBM), keyoard, display device, one disk, and DOS.

System	Workspace Size Memory (Entries)	System	Printer	VisiCalc	Total
Atari 800	18K (1200)	$1,880	$700	$150	$2,730
TRS-80 Model III	23K (1500)	2,200	799	100	3,099
Apple II	18K (1200)	2,690	635	200	3,525
Zenith 89	27K (1800)	2,895	595	300	3,790
IBM PC	88K (5800)	3,735	810	200	4,745
TRS-80 Model II	25K (1700)	3,899	799	300	4,998
Apple III	71K (4700)	4,690	525	incl.	5,215

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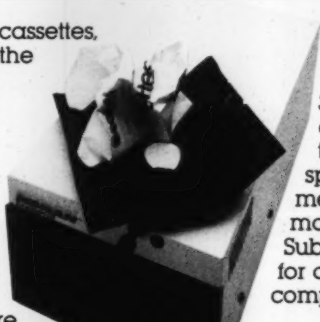

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*requires a 48K, 16-sector disk based APPLE II system

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The number of colors is shown in parenthesis

Computer	Resolution Block/Char	Resolution Low	Resolution Medium	Resolution High
Color Computer	32x64 (8) 48x64 (8)	96x128 (4) 192x128 (4)	192x256 (2)	--
Apple II	48x40 (15)	192x140 (6)	192x280 (b/w)	--
Atari 800	24x40 (4) 48x80 (4)	96x160 (4)	192x320 (2)	--
Apple III	48x40 (15)	192x140 (16)	192x280 (16)	192x560 (b/w)
IBM Personal	25x40 (16) 25x80 (16)	--	200x320 (4)	200x640 (b/w)

Table 4. Comparison of Color Graphics Capabilities

processor chip, probably outstrips IBM for performance. But when a feature comparison is made, I think IBM stands far ahead. Just think what 25 x 80 text mode means!

DOS

One of the real bargains on IBM's software shelf is their Disk Operating System (DOS) for the Personal Computer. For $40 you get a system which is about equivalent to CP/M in features, and which includes both Disk and Advanced Basic. Also included on the disk are three software development tools: DEGUG, a memory-based debugger; EDLIN, a line-oriented text file editor; and LINK, IBM's language link editor. DEBUG and LINK will only be of interest to system developers, and I will not detail them here. EDLIN is useful in general, but it is so simple to learn and use that I'll leave it as an exercise (I always wanted to say that). I have been told that some Basic programs will be included to serve as programming examples. I was also told that these would be the dealer demos.

Table 5 lists the DOS commands and the functions they perform. Here again I have little upon which to comment. I will mention that I timed FORMAT, DISKCOPY, and DISKCOMP commands. Formatting a disk took 34 seconds. Disk copying required 52 seconds. Disk copying using only one diskette drive required one minute and 38 seconds, and required four disk manipulations. Disk comparison required 33 seconds. All these times are quite reasonable.

I will also mention that I was impressed with the "smoothness" of operation of DOS. Messages and prompts were very clear and I was never at a loss for what to do next. The only problem I encountered was in the DISKCOMP program, which refused to let me abort it, and placed the system into a state which could not be cleared by anything less than a power up sequence (ALT-CTRL-DEL would not do it—I had to hit the red switch!) Nothing else I did caused any problems.

For $40 you get a system which is about equivalent to CP/M in features.

Applications

There are three software systems which IBM is providing initially. All have been reviewed by *Creative* at one time or another, so I'll keep it brief.

IBM selected accounting software from Peachtree Software, which has an excellent reputation in this field. General Ledger, Accounts Payable, and Accounts Receivable are available. I ran the Accounts Payable system to get a feel for how it operates. I can only report that operation was straightforward, but a careful reading of the documentation is essential. The software does take some advantage of the IBM display and keyboard.

EasyWriter from Information Unlimited Software, Inc. should be well-known to Apple owners and *Creative* readers. I read the manual carefully and tried the system. I can report that the program lives up to its name—it is very easy to use. I was interested to learn why IBM chose EasyWriter. The answer I got was that IBM had done a careful study of word processing software ranging in price from $30 to $600 and up and decided to select a package priced somewhere in the middle. Also contributing to the decision was time; since EasyWriter is written in Forth, it was readily ported to the 8088.

I do have one strong objection to this word processor: it uses its own file system and thus cannot read VisiCalc reports or other DOS files.

IBM's VisiCalc is the most recent edition of that famous system from Personal Software/Software Arts. The recent enhancements include the ability to edit formulas, print formulas, output to the RS-232 port, and write files in the DIF (Data Interchange Format). One problem I noted was that VisiCalc (called VC80 in DOS) expects to be loaded from disk A. I caused an error when I tried to run it from disk B. Two advantages are that scrolling (on the Monochrome Display) is flicker free and very fast and that the Typamatic feature of the keyboard can be used with cursor movement keys to scroll anywhere rapidly.

I did do a VisiCalc benchmark. I entered a very small spreadsheet consisting of 11 legends, 6 numbers, and 98 formulas. Using my very accurate Casio AQ-2000 clock/

Table 5. IBM Personal Computer DOS Commands

Command	Function
CHKDSK	Check disk and report status (space used/left)
COMP	Compare files
COPY	Copy files
DATE	Enter Date
DIR	List filenames from disk
DISKCOMP	Compare diskettes (physical)
DISKCOPY	Copy diskettes
ERASE	Delete files
FORMAT	Format diskette
MODE	Set mode for printer or display
PAUSE	Causes system to wait
REM	Display Remark
RENAME	Rename files
SYS	Transfer DOS system image to formatted diskette
TIME	Enter time
TYPE	Display file contents

calculator/calendar/stopwatch, I clocked the time it took to recalculate the entire sheet by entering a number in the upper left corner and waiting for the lower right entry to be updated. On the IBM machine this took 2.6 seconds. I ran the test three times. On a Radio Shack TRS-80 Model II the same test took 2.1 seconds. To say the least, I was surprised, and I have no explanation for the result. IBM told me that they had done some benchmarks for VisiCalc performance, and that the Personal Computer had beaten all challengers.

This implementation of VisiCalc is disappointing in one respect. In a 64K system, VisiCalc leaves about 24K of workspace. If you add memory to the machine, the workspace can rise to about 36K, but not higher. IBM says the next release is in the works and will allow the workspace to be all of available memory. This would mean 88K of workspace in a 128K system. IBM says that there will be a slight charge for the new version, even to people who paid for the original version. It seems silly for this not to be perfect on the first release.

Pascal

I ran out of time before I got a chance to pursue Pascal. IBM tells me it is Microsoft Pascal-86, which is highly optimized and produces very tight direct code. Programs can run in systems with less than 128K of memory but the compiler requires that much to execute. Pascal programs can be greater than 64K, up to the limit of available memory.

> ***The documentation, at least that which I have seen, is superb—truly excellent.***

Games

IBM announced two "entertainment" products for the personal computer, one in software and the other in hardware. The soft product is Microsoft Adventure. I played it briefly, and recognized it as relatively standard Adventure. It is supposed to have some good features, but I'm not a good enough player to get far enough to learn about them.

"...Looks like space junk..."

©CREATIVE COMPUTING

The hard product is called the Game Control Adapter. This adapter can interface two joysticks or four paddles, none of which are supplied by IBM. The only thing I can tell you is that I saw a drawing of joysticks while I was visiting IBM and they look like Radio Shack joysticks.

Diagnostics

IBM offers a package of diagnostic programs called the Advanced Diagnostics Package. The package costs $155. I tried them and although they did not find anything wrong with the system I was using, I found them to be well designed, at least from the human factors point of view. They are coordinated with the Guide to Operations manual, and it should be possible for non-technical people to use them effectively.

I object, however, to their cost. IBM should be able to save themselves that cost by placing the very best diagnostic tools possible in the hands of the user. Such a gesture would probably improve the owner's ability to localize the problem, making it possible for IBM to deal with a greater percentage of truly broken equipment. If IBM won't give them away, I would at least plead for a more reasonable price.

Documentation

The documentation, at least that which I have seen, is superb—truly excellent.

The "IBM Personal Computer Reference Library" is a set of manuals printed on 5 1/2" by 8 1/2" paper and bound in standard 9" 3-ring, looseleaf binders. A rigid slipcase is provided so that the manuals will stand properly on a shelf. The binders are color-coded so they can be quickly identified; the colors are muted pastels and quite attractive.

The insides are just as nice. The Basic manual is a good example, but these comments apply as well to the other manuals I saw. The Basic manual is organized as a *reference* manual. In the reference section, one or more pages are devoted to each Basic keyword. The keyword appears in large, bold typeface at the top of each page to which it pertains.

I have found the information content to be high, but clear. The writing is excellent. I have read the manual several times and have not been able to contrive a question for which the manual did not have the answer. The index and table of contents are complete and helpful. Since the reference section is arranged in alphabetical order, use of the index will be rare. Two colors are used throughout. Black is used for the text, green for examples.

With each system delivered, IBM provides the Basic manual (which is considered part of the Hardware reference series) and the Guide to Operations. The Guide

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tells the owner how to setup the machine, how to operate it, how to run the diagnostics and determine the nature of problems, how to install options (option sections are not included, but come with the option when purchased), and how to pack the unit in the event it must be moved or shipped. The DOS manual comes with DOS and includes sections on the DOS commands, EDLIN, LINK, DEBUG, error messages, DOS technical information, DOS diskette allocation, DOS interrupts and function calls, and DOS control blocks and work areas.

IBM plans to publish a Technical Reference Manual as soon as possible, probably early next year. This document will provide detailed information on the entire system and will include schematics. There will be a charge for it.

Summary

I have been following the trade press very closely, watching the reaction to the Personal Computer. I have been surprised at one view which seems to be shared by most writers—they say the IBM Personal Computer is not cheap.

That much is true, it's not cheap. The Sinclair ZX80/81 is cheap. The Radio Shack Color Computer is cheap. And it's true, the IBM machine has a relatively high entry level price tag. But when a careful comparison is made of machines at the entry level that includes considerations of performance, feature and function, and growth potential, it becomes clear that the IBM Personal Computer is a very cost effective choice. Its architecture should give it a long product life, and its membership in the 8086 processor family assures an upwardly compatible follow-on product. In short, it is a good choice now and a viable one for the future.

Conclusion

I'm going to buy one as soon as I can.

Acknowledgements

First, thanks to Betsy Staples for taking a chance on me.

The folks down at IBM, Boca, were very helpful. They are somewhat handicapped by traditional IBM policy, which is not well suited to the personal computer business. They tried hard to get me what I wanted, and when they couldn't, they just frankly told me so. Thanks to Jeannette Maher and Hal Jennings, who spent the better part of two days hovering over me, tolerating my questions, both reasonable and ridiculous, and quietly and patiently answering them. Mel Hallerman gave me some valuable insights into Basic and compiled a list of system characteristics. Judy Osborne helped me through my EasyWriter session. □

CIRCLE 399 ON READER SERVICE CARD

System Configurations and Pricing

I think there are four interesting configurations of the IBM machine. Of course, there can easily be many variations of these configurations, but these should give an idea of general pricing.

1a. Home system, entry level

System unit, 16K RAM, keyboard	$1,295.00
Color graphics adapter	300.00
Total	$1,595.00

1b. Home system, entertainment

System unit, 16K RAM, keyboard	$1,295.00
48K expansion memory	270.00
Color graphics adapter	300.00
Game control adapter	55.00
Total	$1,920.00

2. Small Business System

System unit, 64K RAM, keyboard	$1,565.00
Display/Printer adapter	335.00
IBM Monochrome display	345.00
IBM Printer	755.00
IBM Printer cable	55.00
Diskette adapter	220.00
Two diskette drives	1,140.00
DOS	40.00
Total	$4,455.00

3. Fortune 1000 VisiCalc Machine

System unit, 128K RAM, keyboard	$2,105.00
Display/Printer adapter	335.00
IBM Monochrome display	345.00
IBM Printer	755.00
IBM Printer Cable	55.00
Diskette adapter	220.00
One diskette drive	570.00
DOS	40.00
VisiCalc	200.00
Total	$4,625.00

4. Scientific/Academic System

System unit, 128K RAM, keyboard	$2,105.00
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CIRCLE 159 ON READER SERVICE CARD

Crush, Crumble and Chomp

The Monster Mash

creative computing software evaluation
INTERNAL REVENUE SERVICE
CFD

Larry Kerns

creative computing
SOFTWARE PROFILE

Name: Crush, Crumble and Chomp

Type: Fantasy

System: 16K TRS-80, 48K Apple with Applesoft

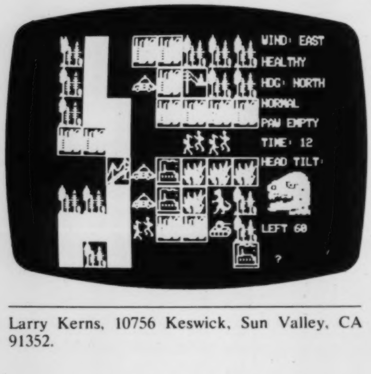
Format: Disk or Tape (Disk only for Apple)

Language: Basic

Summary: A classic.

Price: $29.95

Manufacturer:
Automated Simulations, Inc.
Dept. 103, P.O. Box 4247
1988 Leghorn St.
Mountain View, CA 94040



```
WIND: EAST
HEALTHY
HDG: NORTH
NORMAL
PAW EMPTY
TIME: 12
HEAD TILT:

LEFT 60

?
```

Larry Kerns, 10756 Keswick, Sun Valley, CA 91352.

Have you ever wanted to crush a building or see a giant bridge crumble? Have you ever dreamed of chomping on one of your enemies?

If so, I've got a game for you! It's called *Crush, Crumble and Chomp*! (Automated Simulations). For just $29.95 you can spend many enjoyable hours being your favorite movie monster while the computer contents itself with the role of the poor humans.

> ***Goshilla is a Godzilla look-a-like that leaves a trail of corrosive radioactive waste wherever he goes.***

This game is available for the TRS-80 or Apple in either tape (16K) or disk (32K). The Apple version gives you the more delightful graphics, and the disk versions allow you to custom-design your very own monster. Otherwise, you have six monsters from which to choose.

There is Kraken, a giant squid type that loves to crush buildings. He can also paralyze and atomize with his destructive ray. There is Mantra, the flying pre-historic monster. He has an ultrasonic scream that will knock your ears off, and can breathe fire as he flies.

The glob is also present. He is unique in that he doesn't have a front to worry about (makes for fast turning). He can descend and move subsurface (makes him awfully hungry though), and he leaves a slime trail that bursts into flames when exposed to the air.

Goshilla is a Godzilla look-a-like that leaves a trail of corrosive radioactive waste wherever he goes. He can swim, descend and move subsurface, atomize, and even zap pesky helicopters with his ray beam—generally, a good all around monster.

Arachins is a giant spider that can paralyze nearby units, weave a web to stop traffic and breathe fire. Mechismo is a powerful character in that he never tires or gets hungry (a major weakness of all the other monsters). Mechismo is a giant robot and can stomp, crumble, atomize, zap or breathe fire.

The monsters never win; they will last about 30 minutes with a little care, however. It is only a matter of time before the humans (especially the Mad Scientist) get them, but you accumulate points along the way depending on what objectives you choose.

You could pick "Balanced" and get points for nearly everything you do. "Killer monster" means that you want to kill humans (eat them, you'll live longer). "Combat machine" gets you points for killing human combat units. "Destruction"

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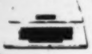

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CIRCLE 306 ON READER SERVICE CARD

means that you like to see buildings fall, while "Survival" is the most noncombative choice.

You have four cities from which to choose. The screen can only display a few blocks at a time, but a complete map of all accessible areas is provided. I never used the maps myself; it just didn't seem right that a monster from the deep should be able to follow a map around New York City, San Francisco, Washington D.C., or Tokyo.

All cities have plentiful water areas, dreaded power plants, and other points of attraction. I enjoyed smashing the IRS building in Washington, D.C. but you might prefer tearing down the Golden Gate Bridge better.

The sound routines provided are a bit tiring, but they can be bypassed. You can select either a fast or slow speed of play. I also had trouble with one of my monsters. It has a bug in it which causes the program to lock up after just two or three moves. The TRS-80 version also needs a shape table to help figure out what the various shapes are supposed to represent.

A typical game might go as follows: Goshilla suddenly appears in Tokyo near the Ara River. He can see but a few blocks in front of him, but all is quiet. He swims along the river over to the downtown area where all the big buildings look attractive. He sees a few humans running around, but he is not hungry yet so he doesn't get too excited. He crosses the Simuda River and stands near the Ginza.

It's time to let them know who just arrived in town so he crumbles the building.

I enjoyed smashing the IRS building.

Gee, that was easy. He goes down to Tokyo Tower where he finds three human mobs. He chases one over a block before he grabs it. He eats it. Yum, yum! It feels like a pin prick. But since several hundred pin pricks will kill him, he grabs it and eats it.

Goshilla then heads up toward the Imperial Palace. It would be neat to crush that, but a tank and an artillery piece suddenly appear and block his way. They fire and hit him. Goshilla goes from "healthy" to "scratched," and he is getting hungry besides.

There are two helicopters buzzing around and they are giving him a headache. He moves into the same space as the tank and stomps on it. Go 'em. He then zaps one of the helicopters and tries to atomize the artillery. Instead, he turns two buildings into ruins. By now, he has stood in one place too long and has attracted a crowd, so he burrows underground and moves five blocks west.

When he reappears, he is so hungry he goes berserk. He grabs a tank and eats it. Not much meat, but it is filling. Goshilla then runs rampant for a while, occasionally listening to reason, but not often.

When he finally regains control, he is still hungry and is now hurt.

All at once, the Mad Scientist appears. Run, Goshilla. Run! "Oh, he got me." He is not bleeding, but he feels very chilled and everything is going black. Humanity has triumphed again—630 points.

Overall, this is an excellent program. It is well worth the money and involves the player thoroughly. It is like a computerized "The Creature That Ate Sheboygan." If you liked that game, here is a ready opponent. You're the monster. It's a classic. □

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[illegible] Cops & Robbers was programmed by Alan Merrell [illegible] Epoch was programmed by Larry Miller. Orbitron [illegible] by Eric Knopp. Gamma Goblins was programmed [illegible] Nasir. E-Z Draw was programmed by Nasir Gebelli [illegible] Pascal Graphics Editor was programmed by [illegible] was programmed by Mark Turmell. Gorgon, [illegible] Both Barrels, Star Cruiser, Cyber Strike [illegible] II were programmed by Nasir.

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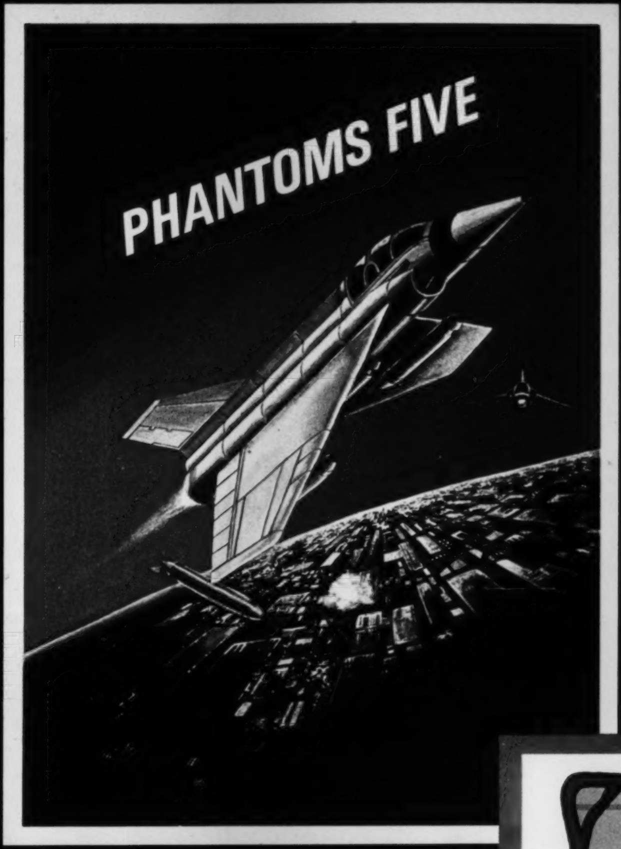

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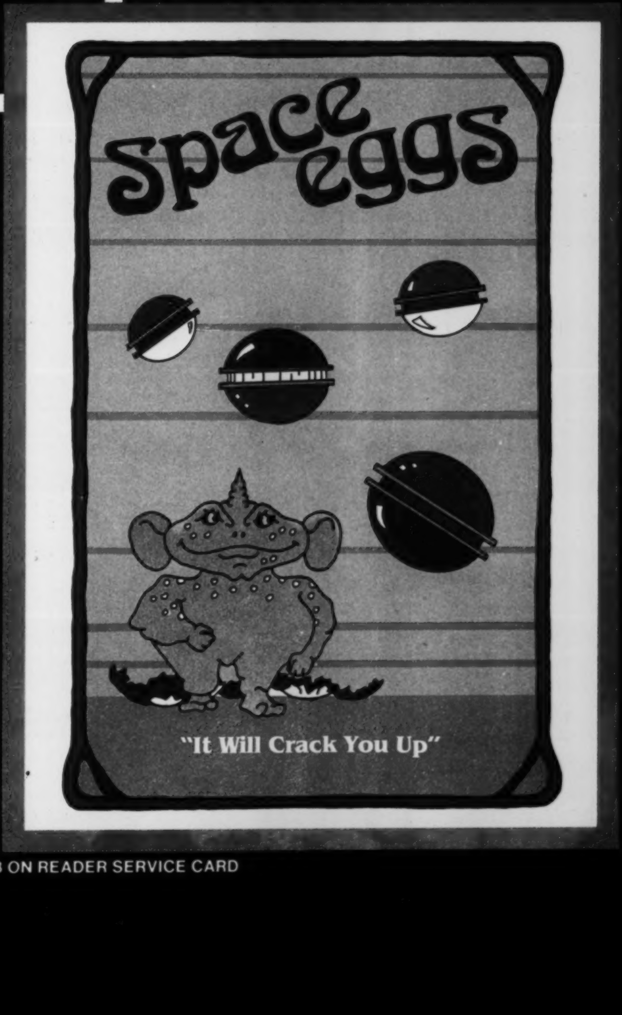
Space eggs
"It Will Crack You Up"

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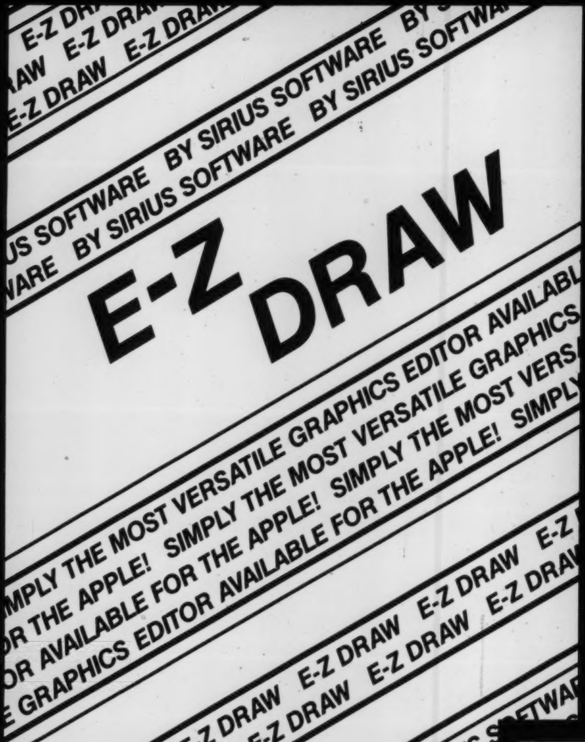
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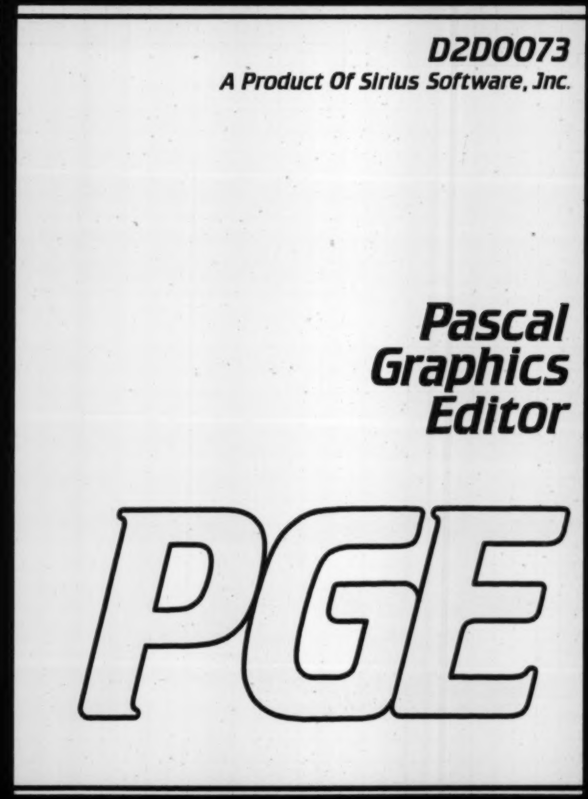
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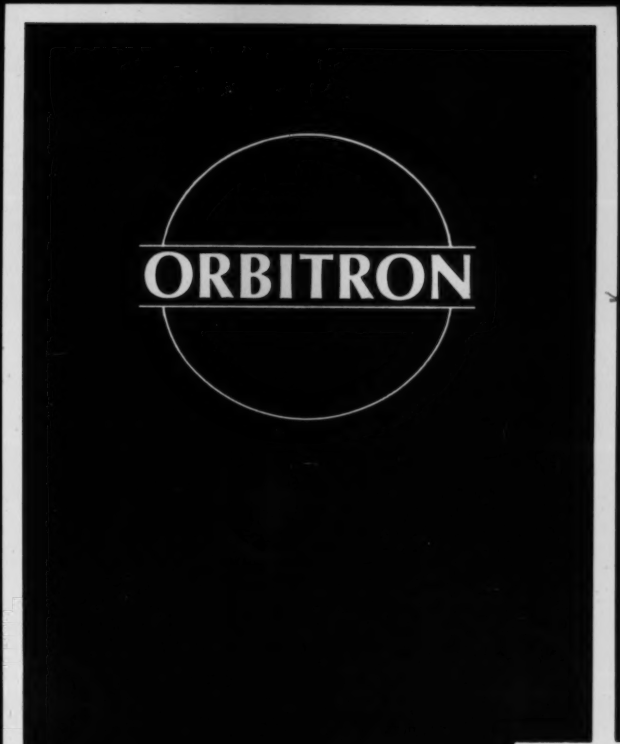

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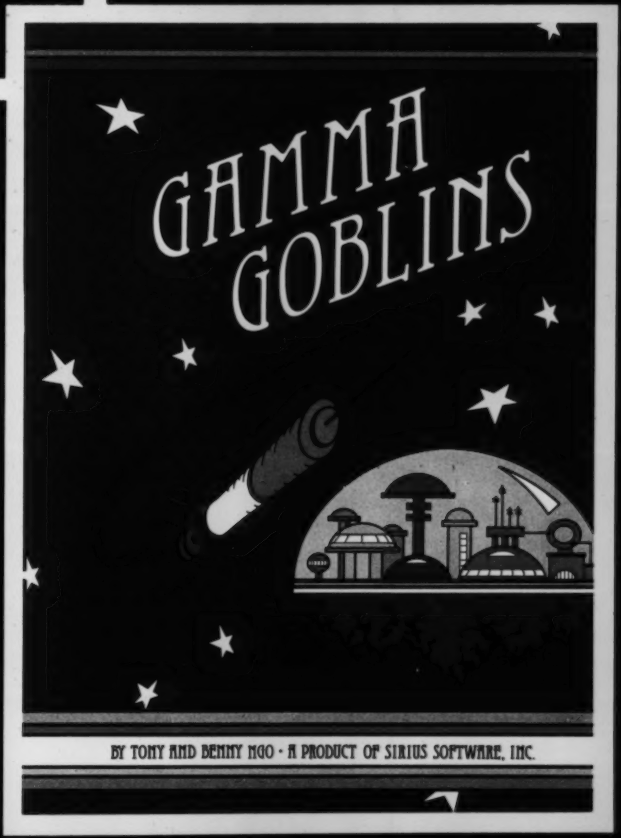
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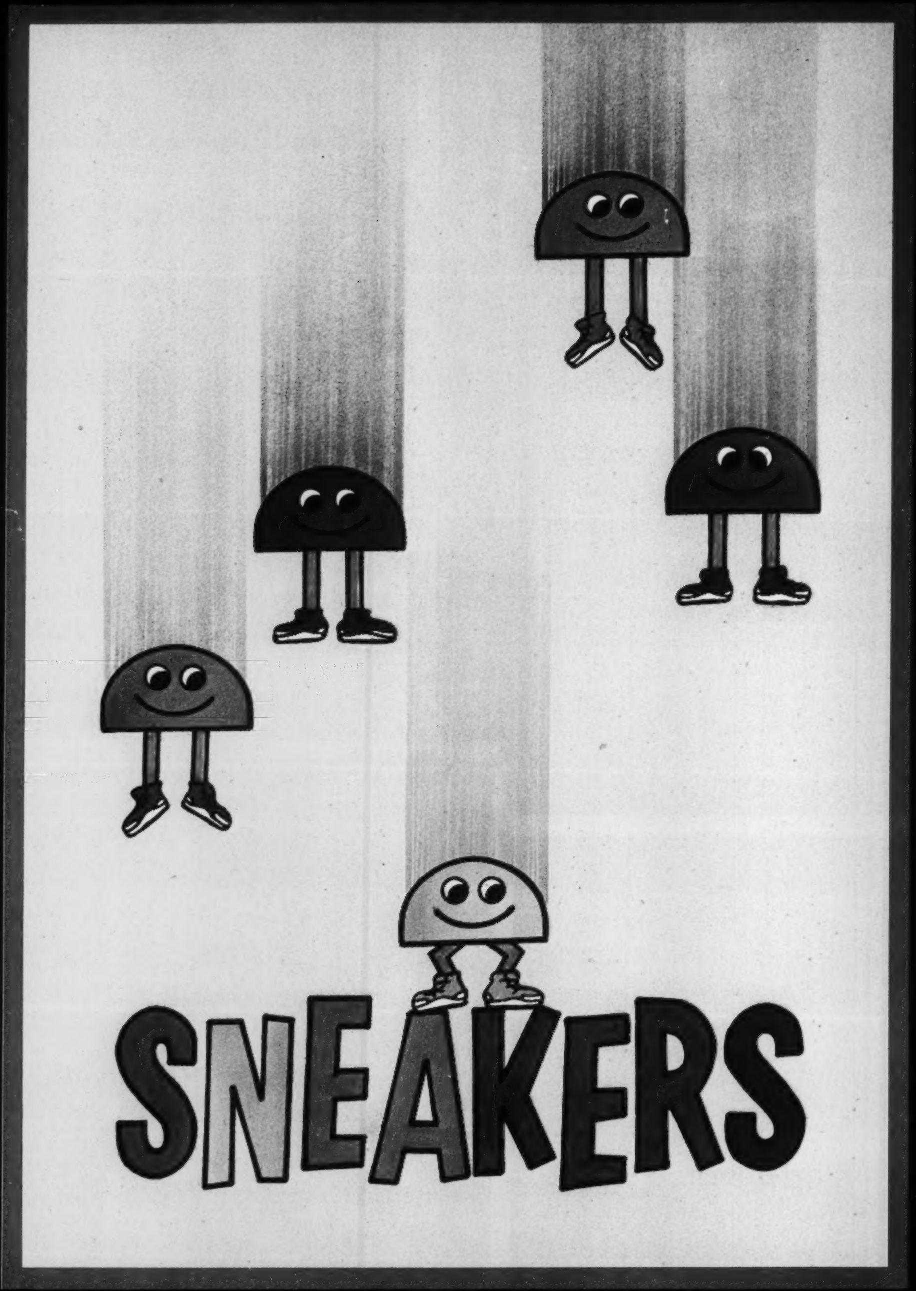

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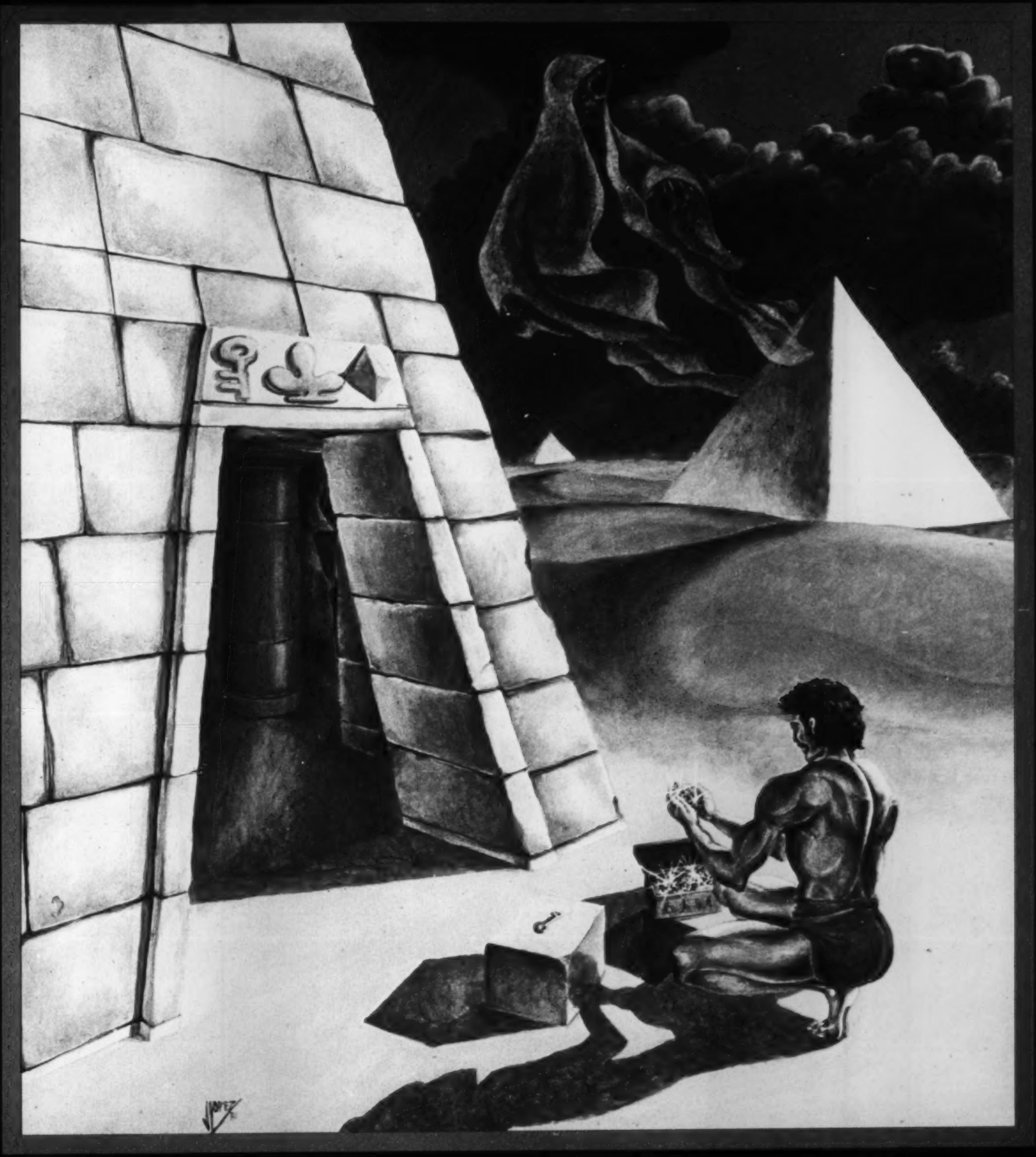

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CIRCLE 238 ON READER SERVICE CARD

Mac from Entex

creative
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The Smallest Mini On The Market

David Lubar

MAC is the tricycle of the computer age. It is geared for beginners, has a few bells and whistles, but it can't go too far. MAC, according to the booklet that accompanies him, is a mini computer. MAC can function in many modes, acting as a calculator, an organ, a game machine, or a programmable computer. The unit features a multi-function keyboard, four-by-four dot matrix display, built-in speaker, and a numeric display bar. In the calculator mode, MAC does addition, subtraction, multiplication, and division with up to eight digits. He also has a memory key which can store the most recent value displayed. The instructions cover these functions and also explain how to use constants and perform exponential calculations. There is also a good tutorial on negative numbers. The section concludes with several games that can be played in the calculator mode.

The game-playing mode has four games: concentration, tic-tac-toe, slot machine, and tactics. The tic-tac-toe game is a disappointment. The computer is merely the referee, displaying the squares selected by two human players. The computer isn't even smart enough to know when there is a winner. Concentration is fun. Two players take turns selecting pairs from a four-by-four grid. If the pair is a match, the numbers remain lit and the player gets another turn. Tactics is a simplified version of nim. Two players take turns switching off lights on three grids, playing until someone is forced to switch off the last light. Slot machine is a game requiring good reflexes. The player or players try to stop the moving lights in patterns that are worth points. Also available from the game mode is a program that will tell the time in different areas of the world. The player enters the time in his location, then gives the time zone of the desired place. Mac responds with the time in that nook of the world.

Mac can be played with either an organ or piano sound.

In the music mode, Mac can be played with either an organ or piano sound. The organ sound sustains as long as the key is held, the piano note decays rapidly. Mac can also record and play back music. The user can either enter a song by playing it on the keys, or enter a series of values for pitch and duration. While the "programmable" method is more tedious, it allows for more variations in duration and for half steps in the two-octave range. There is no way to edit mistakes when entering music. If there is one slip, the only way to fix the music is to re-enter the entire score. Children might find this frustrating.

Being a computer, Mac is, of course, programmable. The language is somewhat limited, but could be a good way to introduce children to the concept of programming. Commands are entered as two-place decimal numbers, and perform the functions of turning the LED's on and off, and generating tones. As with the music mode, there is no way to edit mistakes, so programmers would be advised to write out their code before entering it. The manual contains several sample programs for games that can be played on MAC. Each game is accompanied with a card that slips in front of the display window, blocking off unused lights.

While "mini computer" might be somewhat of a grandiose title, MAC does provide the owner with a programmable, game playing computer. Children will enjoy MAC, and parents might even get a kick out of making MAC flash their initials or finding out what time it is in Kuala Lampur.

MAC is manufactured by Entex Industries, Inc., Compton CA, 90220. ☐

CIRCLE 397 ON READER SERVICE CARD

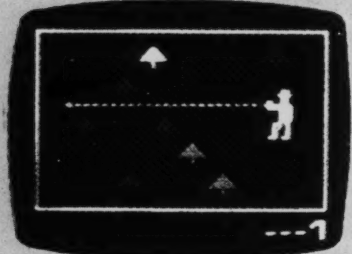
ODYSSEY HITS NO HOMERS

creative
computing
equipment
evaluation

David Lubar

Odyssey^2 from Magnavox is a computer video game system with a nice appearance, great packaging, and little else. The unit includes a membrane keyboard, two built-in joysticks, an AC adaptor, and a slot for game cartridges. Hooking up the Odyssey is a simple task; as with most video games, it plugs into a switchbox that attaches to the VHF line of any television. The cartridges are nicely designed with a handle for easy insertion. The instructions warn against pulling a cartridge when the power is on, but there is no light to indicate whether the juice is flowing, virtually guaranteeing a zapped ROM sooner or later. The joysticks are surprisingly flimsy. One failed in the middle of a game. We opened it up and fixed a disconnected cable, after which it worked fine. However, a view of the interior convinced us that the hardware wasn't designed for rugged use.

Odyssey offers color graphics and sound. The sound comes through the TV and is definitely an enhancement to the games; the graphics are low resolution. Along with the unit, we also received a selection of cartridges for review, as well as the highly touted *Quest for the Rings Game*. Details follow.



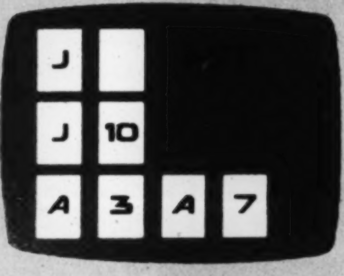
Showdown in 2100 A.D.

Alien Invaders—Plus

This is a variation of the well-known arcade game. The player has a huge triangle at the bottom of the screen. The triangle can be moved back and forth using the joystick. The player fires using the button attached to the joystick. Above the player are eight robots, eight cannons, and eight barricades. To win, the player must destroy the robots. The Invaders move back and forth in a jerky fashion. They also move downward occasionally. Above all this is a "Merciless Monstroth," which shoots at the player. If killed it returns. Against these terrible odds, the player has the aid of three blockades. If he is hit, he can get another cannon from a blockade. Each cannon gained results in the loss of a blockade. The game doesn't present a score in the usual manner. Instead, the player gains one point for killing all robots while the aliens get a point if they kill the player. The first side to reach ten points wins. This is a one-player game with no options or variations. According to the package, it is a "multi-mode game cartridge." That phrase seems to stretch the truth slightly.

The instructions warn against pulling a cartridge when the power is on, but there is no light to indicate whether the juice is flowing.

Las Vegas Blackjack



Las Vegas Blackjack

Well, not exactly. The player can hit or double, but he can't split his cards. Also missing from the realism of Vegas is the ability to go into debt. Apparently, the Odyssey doesn't deal well with negative numbers. At one point during play, a loss on a doubled bet put one of the players under, causing the game to display a twos-complement version of his score. It told him he had 9991024 dollars left.

Putting this aside, the game is standard blackjack. One or two players make a bet, decide whether to hit or stand, then watch the dealer draw. The computer sticks to the rules, drawing cards until it reaches a value of seventeen or higher. Despite the problem with negative numbers, this cartridge was one of the more enjoyable in the batch we reviewed.

Showdown in 2100 A.D.!

A version of gunfight for one or two players, this game was fairly entertaining, though the gunfighters had a tendency to jump about the screen a bit. Each player gets six bullets per round. The screen is scattered with trees from which the bullets ricochet, making it possible for a player to shoot himself. The game ends when one player has been killed ten times.

This cartridge does display one nice touch. If only one player is using it, the computer automatically controls the other gunfighter.

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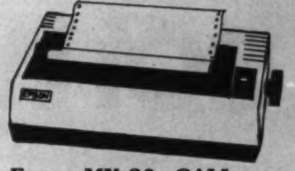

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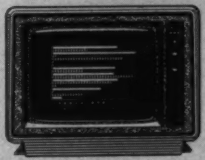

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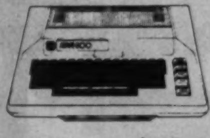

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Odyssey, continued...

Matchmaker!, Logix! and Buzzword!

Matchmaker! is concentration for one or two players. The game displays a five-by-four grid containing letters from A to T. A player selects two letters. If the pictures behind the letters match, the player scores a point and gets to go again. Oddly enough, in the two player version, the score for player one is on the right and the score for player two is on the left. This seems slightly backwards. For those who like concentration, this version is fun.

Buzzword! is hangman without the gallows. The player tries to find a hidden word by guessing one letter at a time. Each correct letter is displayed wherever it occurs in the word. After eight incorrect guesses, the word is revealed.

Logix! is a version of *Mastermind*. The player must guess a five digit number. A display informs him how many digits in his guess match those in the target number, and how many are in the correct place. The screen only has room for six guesses. After this the screen scrolls, losing the first guess.

None of these games offers automatic replay. To play again, the player must press reset, then reselect the game.

The Quest for the Rings

This game is beautifully packaged and illustrated. The box contains a game cartridge, game board and pieces, keyboard overlay, and a rulebook with excellent graphics. Quest is a good idea that, given the limitations of the Odyssey, just doesn't quite make it as a game. The concept is nice; players take the part of characters who roam through labyrinths in search of magic rings. There are four characters; warrior, wizard, phantom, and changeling.

> ***The one positive aspect of Quest is that it is a cooperative game.***

The warrior has a sword, the wizard throws spells, the phantom can walk through walls, and the changeling can become invisible. During play, characters go into rooms and try to reach the magic ring. The rooms are occupied by various monsters. The monsters try to kill the players. The labyrinths aren't really mazes, but rooms filled with obstacles. In the Shifting Halls, the walls move. In the Crystal Caverns, the walls vanish and reappear. In the Infernos the walls are hot and deadly.

While all this might make an attractive game, the slowness and low resolution of the graphics detract greatly from the fun. Quest can be played in several ways. A player can go solo into selected labyrinths, or two players can go for a romp. The full game involves a map and game pieces. One player sets up locations, some of which have rings hidden beneath them. Two other players travel across the map. Whenever there is an encounter, it is played out on the screen.

The one positive aspect of Quest is that it is a cooperative game, thus maintaining the spirit of Dungeons and Dragons. Beyond this, it doesn't live up to its promises.

In Conclusion

When compared to other units on the market, Odyssey² does not fare well. The games are, at best, mediocre, the hardware doesn't seem designed for long life, and none of it comes close to living up to the promotional hype.

Odyssey² is priced around $200 and manufactured by Magnovox Consumer Electronics Company, P.O. Box 6950, Knoxville, TN 37914. ☐

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Children's Discovery System

Betsy Staples

The first time you see Cursor the Great slither across the screen of the Mattel Children's Discovery System, you wonder what's happening. The second time, you realize that he is a dot matrix man running across to confirm that you have turned the machine on. The 30th time, you just wish he would hurry up so you get on with the "discovery."

Cursor the Great is the protagonist in the Activity Books that come with the Children's Discovery System. He explains each activity, and gives detailed instructions for carrying it out.

The Discovery System, which is designed for children aged 6 to 11 and is priced in the $100 to $125 range, is a small computer in a plastic housing with a touch-sensitive keyboard, LCD display and 2K of memory. The keyboard is arranged alphabetically with cursor-control and function keys on the right-hand side.

It is the LCD display which limits the system most severely. It responds very slowly in some modes, and the letters, which are formed from a 5 x 7 matrix, are so large that only 16 can be displayed at once on two lines of eight characters each.

The basic Activity Book, which we assume comes with the machine, and gives instructions for using the three modes that are included in the basic system: type, music and art.

Type Mode

Activities for the type mode are word games, starting, of course, with Hangman. There are sections on palindromes, anagrams, homonyms, synonyms, antonyms, endings, abbreviations, alphabetizing and "creative writing." The explanations and activities are excellent, but since there is no feed back, most could be done just as easily with a pencil and paper. As one of our young testers commented, "I like computers that tell me whether I'm right or wrong."

Music Mode

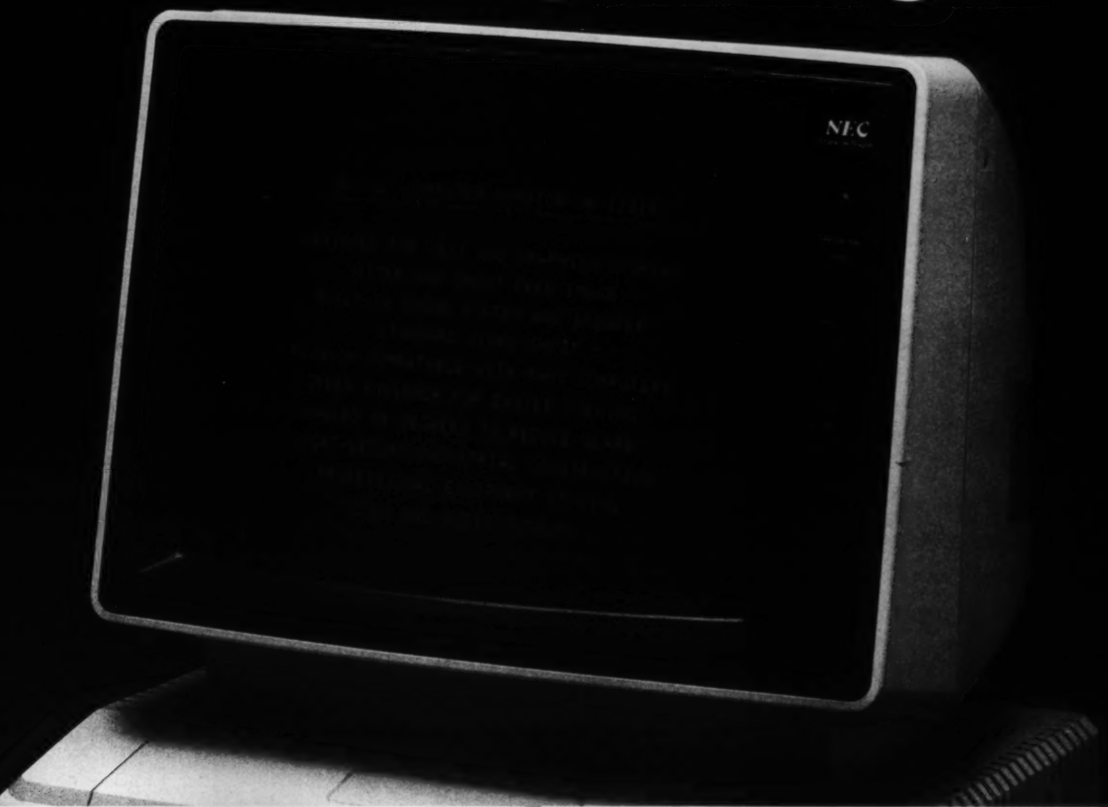
The music mode can best be described as pointless. The first 16 keys on the keyboard—A-N—are the music keys, on which songs in the key of C, which have no accidentals and no more than 16 different notes, can be recorded and played back.

The really bad news is that there is no way to control tempo, or even assign values to the notes. Cursor the Great suggests

ABCD
AB-D
ACCEDGE
CE------

The process of entering music in Music Mode looks like this.

Easy on your eyes and your budget.



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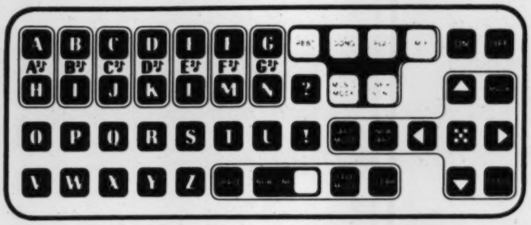


The Music Mode keys are marked in yellow on the keyboard.

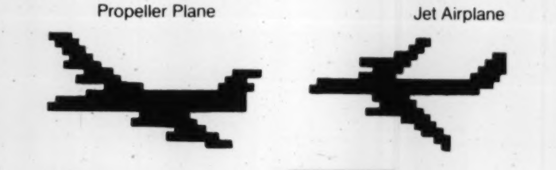
adding rests after notes that should be sustained. This doesn't quite make it.

On a more positive note, again, the explanations are good—particularly the descriptions of intervals and "Major, Minor and 7th Sounds"—and there is a sizable collection of songs which can be played in 16-note segments.

Unfortunately from an educational point of view, there is no connection made between the music produced on the computer and standard musical notation. There is one illustration in the manual of a piano keyboard with a staff overlaid upon it and the typing keyboard letters lined up under the corresponding keys. This is not enough to convince a child that a musician would not expect to see the beginning notes of "Long, Long Ago" written as "C C D E E F."

Art Mode

Art mode is a good introduction to computer graphics and the tedium associated with drawing pixel-by-pixel. The Activity Book offers a bit of art history as well as some hints on technique (perspective) and several games and puzzles to design.



Suggested shapes that can be drawn in Art Mode.

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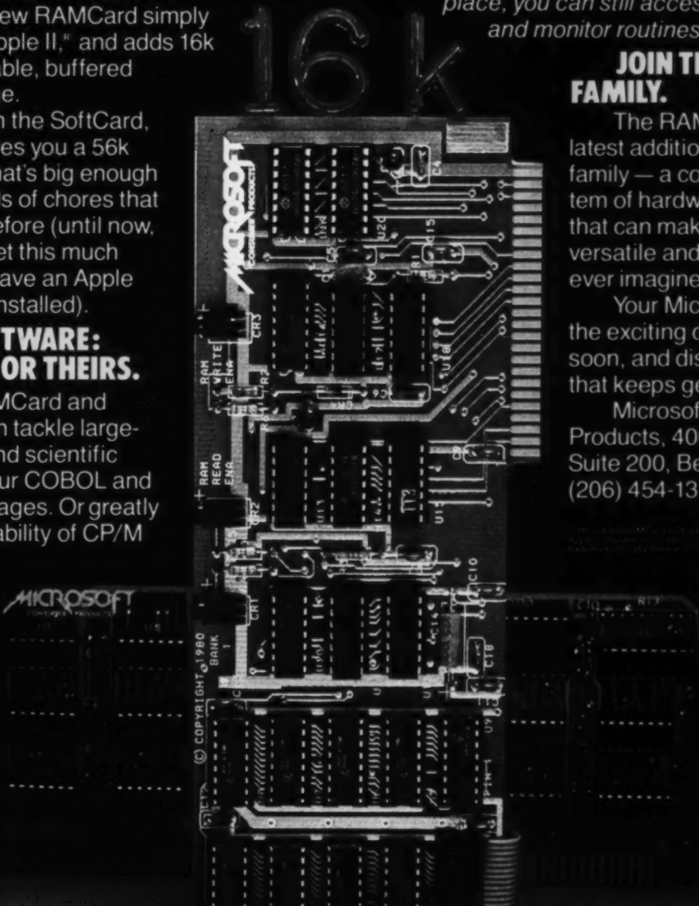

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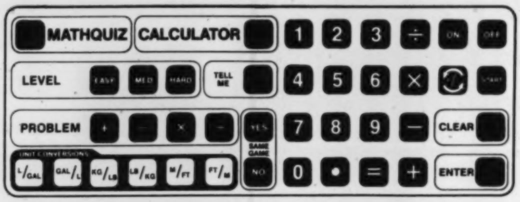
Discovery System, continued...



Math I keyboard.

Discoveries in Math I

Of the software packages (Mattel calls them Learning Fun Modules) we received for review, the best was Discoveries in Math I. The package includes a ROM cartridge, keyboard overlay and activity book. The ROM cartridge slides into a slot on the front of the system. The keyboard overlay decreases the sensitivity of the keyboard.

Math I, which comes with the basic unit, offers a choice between calculator and mathquiz modes. Calculator mode is just that: the machine can add, subtract, multiply and divide numbers that are no more than seven digits long as long as their answers are no more than eight digits long.

Unfortunately, it can only deal with two numbers at a time. To add a column of numbers, the child must add the first two, get a total, then add the next number to it, and so on.

The calculator mode includes a set of keys that perform metric conversions automatically. To find out how many meters equal 27 feet, for example, the child would enter 27 and press the feet-to-meters key. The answer, 8.2296, would appear on the screen.

Aside from the metric conversion feature, the calculator mode does nothing that an inexpensive pocket calculator can't do, but the explanations of rounding and negative numbers are very good, as are the sample problems.

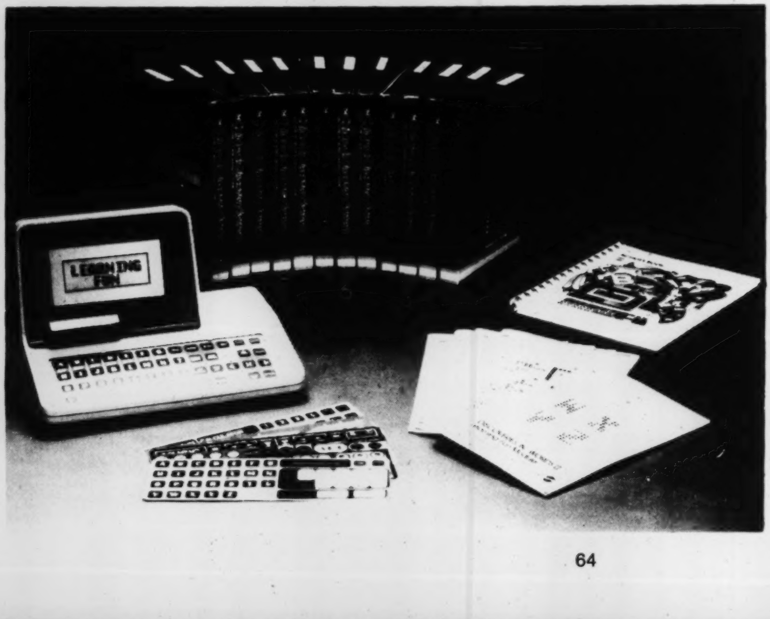
In mathquiz mode, the Discovery System displays sample problems for the child to solve. The child selects the difficulty level he wants and the type of problem (addition, subtraction, multiplication, division) that he wants to practice. If he selects more than one type of problem, the machine will offer a mixture of the types he selects.

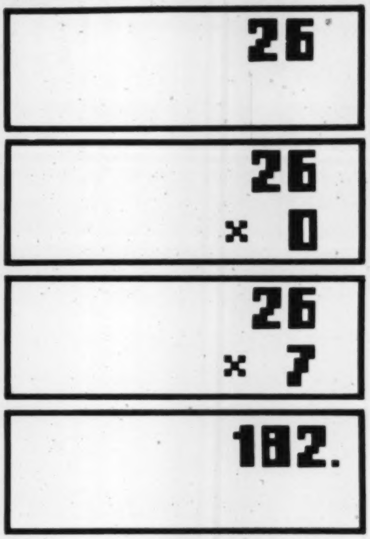
If he answers correctly, he hears a "victory tune" and a new problem appears. If he is wrong he hears "a long low note," his incorrect answer is erased, and he must try again. Short of typing the correct answer, the only way to get rid of a problem is to press the "tell me" key, which gives the right answer and allows the child to move on to the next problem.

In flash card quiz, the child may choose a constant which will appear in all the problems—a handy feature for practicing multiplication tables. Mathquiz includes a lesson on probability and several interesting games and exercises.

After each ten problems, the computer stops to tell how many problems the child has answered correctly.

One drawback is that all problems in this mode are presented in a linear format (465 + 323 =), and the answers must be typed in from left to right. This is not the way most children set up problems in school, and it is certainly not the way they are taught to solve them.





A sample multiplication problem in Calculator Mode.

Another annoyance is that rather than appearing all at once on the screen, the problems chug across from the right-hand side—a very slow process.

Other Software

We were less impressed with the Discoveries in Music and Discoveries in Art modules we examined, although in both cases, the Activity Books were very well done with plenty of illustrations and excellent explanations. It seems that the hardware is just a bit too limited to fulfill the expectations created by the books.

We judged the Discoveries in Arcade Action I extremely tame for a generation of children brought up on hand-held Space Invaders and video game systems. Discoveries in Words I would have qualified as merely "a waste" had it not been for the section on "trick words" in which the child is presented with several lists of suggested incorrect spellings. Suggesting that one might possibly think of spelling "oak" "ok" is worse than saying "don't put beans in your ears"! As a result we rate this cartridge "not acceptable."

Summary

Taken as a whole, the Children's Discovery System certainly has a great deal more educational value than most of the electronic toys and games on the market. It is, however, far from the acme of computer assisted instruction.

With the exception of Words I, all the Activity Books are excellent, and might be worth buying even without the computer. The computer, though, probably lends enough novelty to the learning situation that children will be encouraged to do the activities just because they are "computerized."

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My first inkling that ordinary people could learn to use computers came from a "scholarly paper" about "Turtle Geometry" that crossed my desk at Drew University about five years ago. The title was intriguing, so I read it, even though I knew it had been written by a professor of mathematics, a subject I had striven to avoid since my junior year in high school.

I was shocked to discover that the ideas presented in the paper were not only comprehensible, but quite unmathematical.

Recently, I met Turtle Geometry again on the TI 99/4 computer, and it was even more fascinating, because this time the turtle was at my command in TI Logo.

Developed at M.I.T., Logo is intended to help primary through high school age young people cultivate their problem-solving skills. It has been tested at the Lamplighter School in Dallas, TX, and in the New York City public schools.

Turtle Mode

Let's get back to the turtle. You enter "Turtle Mode" by typing TELL TURTLE. The triangular turtle appears in his home (the center of the screen) and the cursor appears in the lower left-hand corner of the screen.

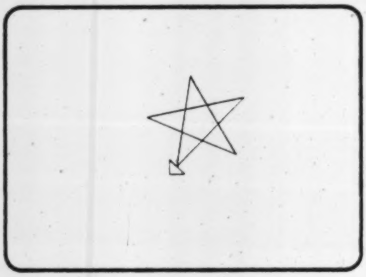
The turtle moves forward or backward. You specify how many "steps" he is to take, and he leaves a line of that length in his wake.

The LEFT and RIGHT commands cause the turtle to turn the number of degrees specified, although the word "degrees" is never mentioned. Thus, the commands RIGHT 90, FORWARD 30 make the turtle turn 90 degrees and draw a line 30 steps long.

If you forget to specify how many steps he is to take or degrees he is to turn, the computer responds with TELL ME MORE. The entire line must then be retyped, including the missing information.

If you make an error in typing the command, "FORWARD 10," for example, the computer says "TELL ME HOW TO . ..." Once again, the entire line must be retyped correctly.

The turtle can't draw forever, and when he reaches the end of his tether, the length of which is never specified, the OUT OF INK message appears, and the screen must be cleared before any more drawing can be done.



```
CLEARSCREEN
FORWARD 50
RIGHT 144
FORWARD 50
RIGHT 144
FORWARD 50
RIGHT 144
FORWARD 50
RIGHT 144
FORWARD 50
```

Figure 1. The turtle draws a star.

Additional commands include PENUP, PENDOWN and PENERASE, which are self-explanatory, and PENREVERSE, which allows the turtle to erase a line he has crossed and draw a new one.

It takes a bit of practice to get the turtle's trail to intersect exactly where you want it when drawing complex shapes, but if you pay attention, you learn something each time you fail.

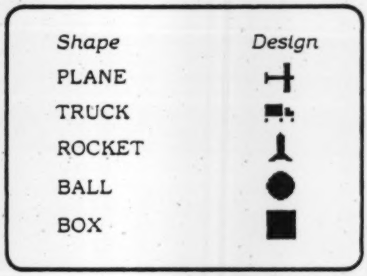


Figure 2. The five basic shapes.

Sprites and Shapes

"What is a sprite? It's an invisible thing you can talk to. You must tell a sprite about itself before you can use it."

The things that a sprite can be told about itself include: shape, color, speed and heading. There are five shapes—plane, truck, rocket, ball and box—built into the language, and an alleged 16 colors, many of which are indistinguishable from others—purple and blue, for example, were identical on my monitor. You can talk to 32 sprites at a time by giving them numbers.

The following sequence:

```
TELL SPRITE 1
CARRY :TRUCK
SETCOLOR :GREEN
SETSPEED 60
SETHEADING 90
```

defines Sprite 1 as a green truck which is, at present, moving at a speed of 60 parallel with the bottom of the screen. To make

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the truck change course and move perpendicular to its current path, you would simply type SETHEADING 0.

Sprites can also be commanded to FREEZE, THAW and move to the center of the screen (HOME). And like the turtle, they can move FORWARD and BACK, and have their headings adjusted with RIGHT and LEFT commands.

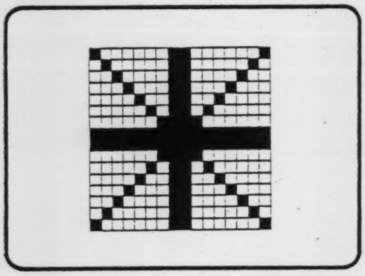


Figure 3. A new shape can be created using the MAKESHAPE command.

When you tire of the five standard shapes, you can design your own using the MAKESHAPE command. Typing MAKESHAPE causes a 16 x 16 grid to appear on the screen, and by moving the cursor around on the grid, you can fill in the blocks that will create the shape you want. The shapes you make can be treated as sprites.

Tiles and Characters

The manual lists "code numbers" for 64 of the 96 characters available on the 99/4. Using the MAKECHAR command, you can modify them at will.

The grids that are used to create new shapes and characters are the "tiles" of which the entire screen is composed. There are 32 columns and 24 rows, and by specifying a character number, column number and row number you can position a character on the screen.

You can also change the colors of the tiles, as well as the background color of the screen.

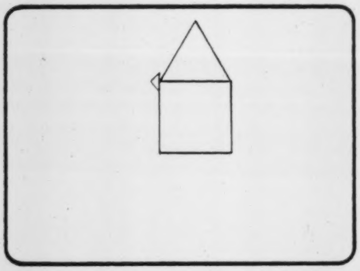


Figure 4. The BOX and TRIANGLE procedures are combined to draw a house.

Teaching Mode

Now that you have mastered the basics, you are ready for some serious programming. The Logo manual, however, never refers to "programs" or "programming." All work done in Logo is accomplished through "procedures."

The first procedure described tells the turtle how to draw a box. "You teach the computer a procedure by typing TO and the name of the procedure." When you type TO BOX, the screen turns green and you are ready to teach the computer how to draw a box.

After you have created the procedure called BOX, you have only to type:

TELL TURTLE
BOX

and the turtle will draw a box.

Procedures can be combined and linked to one another with individual commands as in Figure 4.

In Sprite Mode, procedures can be written using sprites, tiles and background colors. One of the sample procedures in the manual creates four trees using the rocket and ball shapes, moves them off HOME so they are all visible, and changes the color of the tops in sequence to simulate the change of seasons. See Figure 5.

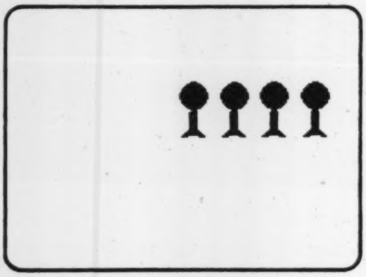


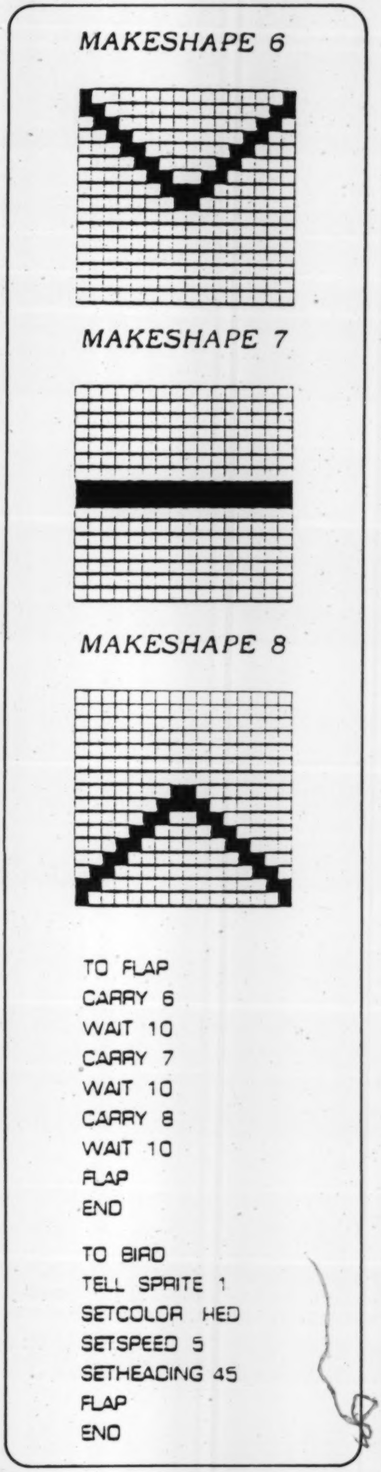
Figure 5. SEASONS: An advanced procedure.

The section of the manual titled "More Advanced Procedures" describes the use of subprocedures, the REPEAT command, variables, the TEST command, IF... THEN...ELSE, and recursion.

Using these advanced procedures, you are able, by the end of the manual, to create a reasonable-looking explosion and a decent approximation of a flying bird. (Figure 6.)

Documentation

In the introductory chapter, several special function keys are described. A very thorough description of the "erase" key is given, for example, but when I looked for the key on my computer, it was nowhere to be found. After some experimentation, I figured out that shift-T was the equivalent of "erase" on my computer.



MAKESHAPE 6

MAKESHAPE 7

MAKESHAPE 8

```
TO FLAP
CARRY 6
WAIT 10
CARRY 7
WAIT 10
CARRY 8
WAIT 10
FLAP
END

TO BIRD
TELL SPRITE 1
SETCOLOR RED
SETSPEED 5
SETHEADING 45
FLAP
END
```

Figure 6. Recursion is used to make a bird fly.

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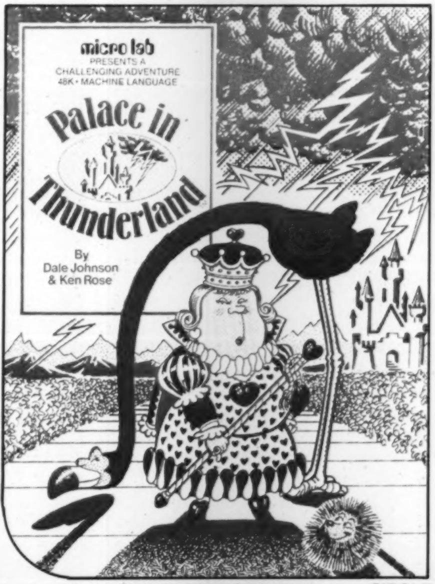
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After repeating this procedure for several other keys, I stumbled on the "Quick Reference Guide" hiding on page vi between the Table of Contents and the "Setting Up" section of the manual. There was no explicit explanation of the alternate keys, but given the information I had already acquired through trial and error, I was able to make sense out of it.

This seems a rather careless treatment of a problem that could be quite confusing to a child or an inexperienced teacher. And even though newer versions of the computer undoubtedly have the required keys, TI should have included the alternate combinations in the text for the convenience of users with older models.

Another minor annoyance was the reference in the documentation to the colon, ":" as "dots." For example, "Never type dots in front of a number." The symbol has a perfectly good English name, and I see no reason not to introduce it properly. The semicolon fares somewhat better. It is referred to as ";". You don't learn its real name, but at least it is spared the indignity of being called "dot-comma." Perhaps TI felt "comma" was too complex a word for children to understand.

With the exceptions mentioned above, the manual is clear and complete with plenty of screen diagrams to show what each procedure ought to be produce. It is written in a slightly condescending style, obviously intended to appeal to children working independently; it probably does.

Summary

Logo is definitely fun. It gives you a sense of satisfaction very early in the learning process by providing instant feedback. The sample procedures are short and simple, and you can see at once if you have made a mistake. If you have done everything correctly, you get immediate positive reinforcement which heightens your desire to move on.

The structure of the course, as set forth in the manual, is modular. One short explanation and an example—drawing a box, for instance—could be an entire lesson for a young child or part of a longer session for a high school student.

The complete TI Logo setup requires the software (command module and disk), the 99/4 computer and monitor, disk drive, disk controller, and memory expansion unit. The suggested price for the software is $299.95. ☐

CIRCLE 398 ON READER SERVICE CARD

Seymour Papert and the Logo Universe

Richard H. Eyster

The event was the first of its size and kind. Dr. Seymour Papert, the twinkling, bearded prophet from M.I.T., was in town for a fortnight. Throughout the summer he and eight hand-picked tutors had worked toward the two-week workshop that was about to unfold. Titled "Computer: A Language for Learning," its scope was a comparison of computer languages, an introduction to state-of-the-art computer technology, and an in-depth exploration of Papert's own brainchild, Logo.

Logo is a child-oriented computer language developed in the Artificial Intelligence Laboratories at M.I.T. Its power derives from its simplicity. It is a language directed toward color, toward graphics, toward children. Its driving forces are a turtle, a demon, and 32 sprites.

The turtle is a triangular animal that follows explicit directions, and leaves a colored track behind, to show where it has been. The demon drifts like a whistle-bearing referee about the screen, measuring distance, watching quadrants, checking conditions. Finally, there are the sprites, nimble, invisible spirits that transport purple snowflakes, grey A's, and rust red submarines across the cyan screen.

The great hope is that Logo is not simply another computer language, but an environment in which children can begin to build, not with their hands but with their heads. It is an electronic Erector Set, a collection of toys only thought can touch. Unlike the great predominance of other available languages that preclude or greatly restrict the access of young children, Logo confers upon the child a limited, rich sense of power.

> ***Papert has set about creating an environment in which geometry is second-nature.***

Each computer language has its bounds and its priorities. There are clearly things, many of them more scientific or business-oriented, more easily undertaken in languages other than Logo. Yet for the young, inquisitive child, it is difficult to imagine a world endowed with more potential. Papert has subtitled his book (*Mindstorms*) "Children, Computers, and Powerful Ideas." One suspects that he might have said "Revolutionary Ideas" but for the political overtones.

He was long a colleague and collaborator with Piaget, and in many ways has borne his classic ideas into the technological age. Building upon the idea that children learn most effectively from models and examples, Papert has set about creating an environment in which geometry is second-nature. Three-year olds bisect the Logo universe with glowing orange lines. Kindergarteners learn to fashion squares by turning turtles 90°. First graders set about erecting small-scale housing developments, all the while learning pleasurable, step-at-a-time mathematics.

Logo has been in existence for several years, and considerable experimentation and refinement have been undertaken. Yet other than the publication of *Mindstorms* and Papert's own work with Texas Instruments and Apple to develop Logo capability, the language has not really moved significantly beyond the research facilities at M.I.T. It was to take the language and his thoughts to the educational community that the two-week workshop was established.

From all across New York, from publishing houses and computer centers, from public schools where Logo is targeted for a September debut and from a farm in Iowa, 60 participants arrived that morning in early August. They worked in two shifts to maximize time on the machines.

Richard H. Eyster, 253 West 72 St. #1508, New York, NY 10023.

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The rule is: What you see on the screen is what you'll get in print. However, if you print using proportional spacing, the result will look even better than the screen.

This typewriter simulation, together with simple to use menu selection of functions and electronic editing abilities, creates the finest word processor available on the standard APPLE II.

MAGIC SPELL

The second feature of an advanced word processor is the ability to find and correct mistakes. The most common mistakes in most documents is the misspelled word.

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By using the BASIC MAILER you can take any mailing list and sort through the list by different criteria and print personalized letters with a few simple keystrokes.

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Papert, continued...

Each participant spent two hours daily listening to Dr. Papert lecture on subjects ranging from the meaning of Piaget to the international impact of computerization. Another hour was spent each day in a special tutorial workshop. Three hours were devoted to largely non-directed exploration of Logo on the Texas Instruments machines.

It was a powerful, persuasive fusion of theory and practice. Participants—the vast majority of whom were teachers—had considerable opportunity each day to explore the Logo universe. On monitors around the conference room, forests arose, submarines lurked, taxis pulled up, picked up passengers, and drove away.

Papert has set himself the challenge of making mathematics accessible.

The power and appeal of Logo are built not upon its color or its terminology. Rather they derive from its accessibility. Papert found himself at the forefront of his field, one of the nations's leading mathematicians. Rather than deal in obscure esoterica that might further promote the elitism already inherent in the field, he has set himself the challenge of making mathematics accessible, almost second-nature.

Conventional mathematics education has taken a terrible toll, creating a wide-spread unease and resistance to things numeric. It is Papert's hope and belief that mathmatical principles learned early, learned naturally, learned first-hand, may provide the sort of initiation into the field that can transform the next generation's view of mathemetics and all of education.

While the three-hour computer sessions provided participants with an opportunity to become familiar with microcomputers and the Logo language, it was Papert's daily address that made the two-week experience especially valuable for many of the participants.

He was a whimsical, unpredictable speaker with a delightful collection of foibles. To call him an absent-minded professor risks branding him as a buffoon. His eccentricities deepen his appeal, and make the glow of his conception that much more approachable. During a thoughtful struggle to find the right words, he took to grasping the podium unconsciously and wrestling with it as he thought, nearly tumbling head-first over it on several occasions.

When he listened to a remark from the audience, he bowed his head, nodding and rubbing his finger across his mustache in thoughtful attention. He had persistent, daily trouble attaching the microphone, and several times it simply fell off, filling the room with thunderous static as he paced back and forth, oblivious to the noise.

He spoke of the dawning technology and the power it provides us. He quietly called into question a great many private assumptions and public prejudices. He talked about education simplified or education transformed.

Future Technology

We have already seen the awesome decrease in price in the production of computer chips, so that now the central processing unit, the heart of the computer, is available for under $1. The current expense derives not from the computer but from the display and the keyboard. Technology is now becoming available which will enable the picture-tube to give way to the flatscreen TV, based on technology not unlike that in the digital watch.

A replacement for the cumbersome keyboard is already available (I have played with one produced by the Children's Television Workshop) as a plastic sheet the size of a place-mat. When volume rises sufficiently to drive down the cost of the flatscreen and the two-dimensional keyboard, computers will be readily available for less than $100. The time-frame is five years.

Current Technology

Robert Mohl, a former M.I.T. student and currently a member of an organization harnessing computer/videodisc technology, spoke as a guest lecturer. He demonstrated a system already available in which the participant can control the computer through voice commands, by touching the computer screen, or by pointing from across the room.

Teleconferencing techniques, by which it appears that a group of executives from around the country are actually in the same room, are already being developed. A videodisc system enables the viewer to move at will about the town of Aspen, Colorado, driving down any street, turning in any direction, asking for information and old photographs of turn-of-the-century houses, retracting to a bird's-eye view of the entire town. One selects the intersection again, simply by touching the screen display.

Ratio of Students to Computers

Even now, even before the price begins its final descent, Papert argues for one microcomputer per child. He cites educational advantages and the break-away superiority of a nation with computer-educated masses. He cites the figure of $25,000-$40,000 as the current per child cost for education. With computers already available at $500 apiece, a child could be guaranteed a personal computer—even with occasional replacement or upgrade—for approximately 5% of the cost of his education.

Impact on the Workforce

Papert quotes with deep concern the latest *Business Week* forecast of some 45,000,000 people needing to be re-trained for careers rendered obsolete by large-scale computerization. He speculates on the emergence of education as the primary concern of society in the coming years. However, its student-teacher ratios, its emphasis on adult re-training, and its impact on the role of the individual teacher may be far afield from our conventional views of education.

Papert equates computerism with racism and sexism.

Role of Computer Specialists

On the role of mathematicians and computer specialists:

We have before us the opportunity to design the future, not simply to predict it. The largely white, male, technocratic structure that has profited so richly in the past stands now to move ahead of the rest of society by immeasurable degrees. There is the possibility that those with the opportunity to create languages will devise languages with increasing difficulty and shrinking access, thereby solidifying and magnifying the power of those already enfranchised.

There is, nevertheless, the opportunity to demystify the exotic, simplify the arcane, and render the computer simple, accessible and democratic. In Papert's own words, the choices before us are not so economical or educational as they are political. We have the ability, then, either to restrict or to disseminate the power of technology.

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Papert, continued...

Computerism

Papert equates computerism with racism and sexism, insofar as the vocabulary of an idea has profound and subtle influences on the shape and evolution of thought. To date, computer vocabulary has tended toward the esoteric, the masculine, the jargonized. Even in a world as enlightened as Logo, the five shapes pre-packaged into the system (a rocket, a plane, a ball, a box, and a truck) are more conventionally boy/military-oriented than one might hope or expect. Even this goes to substantiate Papert's emphasis on the importance of the coming decade.

We still have enormous, nearly infinite choices before us. However, as the choices become conventions, and the conventions become accepted practice, the petrification of alternatives sets in, and only a major revolution can accomplish what a simple decision can accomplish now.

A favorite metaphor of Papert's is the evolution of the QWERTY keyboard for the typewriter. QWERTY evolved as a means of arranging the letters to deal with a problem of the earliest, slowest typewriters: placing the commonest keys at intervals to avoid having them strike simultaneously and lock. The fact that technology has now moved far beyond such speed considerations has not allowed for a more rational keyboard arrangement.

Habit and deeply entrenched custom has meant that the earliest, casual decisions have lasted, and are likely to last far into the future. Papert exhorts his listeners to consider the ramifications of decisions made now. If we are to develop ideas that will be the QWERTYs of the future, then let them be well-considered, far-sighted QWERTYs.

Children's Views of Computers

Early Piaget studies indicated that very young children associated life with motion. Clouds were thought to be alive; trees were not. Increasingly, studies are revealing that the criterion for what is living is shifting from motion to *e*motion. Such toys as Merlin and Simon, electronic games that react with light and sound, straddle the world of the living and the nonliving, even for relatively sophisticated children. Such games are thought to possess "brains," and are even accused (in view of the computer's rather insensitive ability to win) of "cheating."

Even the congratulations/too-bad tunes painstakingly selected by Mattel, et al., appear to backfire for young children who completely misinterpret the tunes—it is beyond their experience and imagination to have someone happy to lose, sad to win. The tune Merlin plays when it wins a game of tic-tac-toe is thought to be not sympathetic, but taunting. The shift of criteria for what constitutes life may indeed have profound and subtle implications, particularly as we move into an age of increasingly life-like computers.

It may be that Logo will simply become a language to outgrow—the computer equivalent of training wheels.

Hard Mastery vs. Soft Mastery

Papert spent considerable time during the final lecture delineating what he saw as "hard mastery" versus "soft mastery." Hard mastery is largely ends-oriented, male-dominated, hierarchical, and complex. Soft mastery is process-oriented, step-by-step, simple, interactive, and accessible.

Hard mastery dominates the conventional approach to math and science education—not subjects customarily given over to exploration or built upon concrete models. Rather, they are pyramidic structures to be mastered with few, if any, daily-life examples on which to build. The concepts of cosine and degrees, of quantum and vectors are baffling, even alienating, to many.

We have, in the words of an elderly, wise woman from the New York City Board of Education, "begun to witness an increasingly soft-mastery-oriented culture trying in vain to deal with the unbending, hard-mastery construction of conventional education."

It is the overriding challenge to all those involved in education that we take an active role in the design of the future of education. As long as schools were compartmentalized and pretechnological, there was little chance that an elite few could dictate the course of the future. Now as we cross the threshold into the computer age, it may well be that the foremost challenge, the greatest threat, we face comes from the subtle direction and emphasis of something as simple and primary as a computer language.

There is still much that one can question and second-guess about the structure of the Logo system. The fact is that immediate, colorful, beeping rewards for minimal input may undercut a child's desire to tackle more far-reaching challenges. In that lack of rigor, in that orientation toward quick, simple gratification, some will no doubt see, despite the interactive nature of the language, parallels with the sins of television.

Papert has created a language that serves as an introduction for young children, that belies the myth that computers belong to white-coated PhDs. Yet one can also see ample reason to hope that Papert turns his extraordinary gifts to questions of rigor and information-handling, questions which other, less dynamic languages address more directly.

At this point, Logo is not likely to be harnessed by scientists and researchers, by business interests or even by computer hobbyists. Its priorities are too heavily allocated toward the graphic and childlike. Yet there is an enormous appeal in the Logo universe. Some may see it as simply a "children's computer language."

In the same way, it may be that unless such questions concerning more sophisticated uses are addressed, Logo will simply become a language to outgrow—the computer equivalent of training wheels.

If this should come to pass, that Logo does not or cannot address these long-term concerns, then we may well see a future in which Logo is considered fun but impractical, and everyone beyond age eight will work with more conventional, complex languages.

We have the capability of creating languages that are abstruse and jargon-barbed, high-threshhold languages that will serve to keep out the commoners. We also have the capability of creating languages that open the computer-dominated future to all members of our society.

On the one hand, there is a future perhaps not so different from that envisioned by Hesse in *Magister Ludi*, in which a highly educated, male-dominated elite cloisters itself off from a society falling farther and farther behind. On the other hand, though not without its own risks, there is the opportunity to share the wealth, to provide every member of society with the means of harnessing the power of technology.

That Papert, a member of the elite, has made it his goal to destroy that elitism is a cause for enormous hope. That serious questions remain, that Logo has not yet overcome every shortcoming, is hardly surprising for a language in its infancy. And it may well be that Papert will not be able to resolve every difficulty on his own.

Yet he has set in motion a process, a technology, a world-view that others are sure to perpetuate and refine. In so doing, particularly at this pivotal, formative hour, he may succeed in bringing to life something more powerful and enduring than a turtle, a demon, and a handful of sprites. □

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IMP greatly enhances HiRes graphics. While other printers can only reproduce graphics on a 1 for 1 basis, IMP provides over 20 different aspect ratios, with complete control over horizontal and vertical resolution, placement, and orientation. For example, a chart could be reduced and printed on one portion of the paper, with text added. IMP also enhances APPLE's alphanumeric capability by providing lower case. It's super simple to operate, too, with all printer commands controlled with a simple key stroke. Another plus, IMP is one of the few printers compatible with PASCAL. How is all this versatility made possible? For one thing, IMP has a 2K byte ROM in its special APPLE interface, while others have 256 bytes or less.

The Nitty Gritty

IMP prints 80, 96 or 132 columns of crisp hardcopy at a speed of one line per second. The 7×7 dot matrix has a standard 96 ASCII character set. IMP's stylish low profile case will complement APPLE in any home or office. And, in addition to being distinctively styled, IMP is rugged, with a heavy duty mechanism, ribbon cartridge and single snap-out board for easy maintenance.

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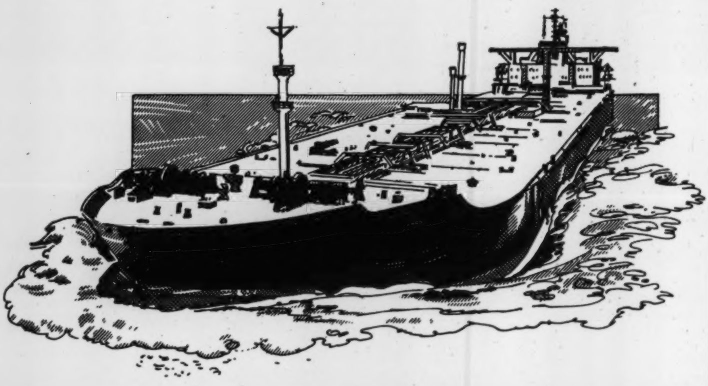
CIRCLE 123 ON READER SERVICE CARD

creative computing software evaluation

Valdez: A Supertanker Simulation

Mike Kohlrust



creative computing SOFTWARE PROFILE
Name: Valdez
Type: Supertanker
System: 16K Apple, PET, Northstar, TRS-80, CP/M, 24K Atari
Format: Disk and Cassette
Language: Basic
Summary: Excellent
Price: $15.95 cassette; $19.95 disk
Manufacturer:
Dynacomp, Inc.
1427 Monroe Avenue
Rochester, NY 14618

To me, a simulation is valuable, in direct proportion to its ability to mirror the world. In a wider sense, games, such as the fantasies that are widely available, are also simulations, but their primary purpose is as games. I feel that the main purpose of a simulation is to tell or teach me something about the real world. If there is fun to be had in the process, so much the better. Valdez succeeds on both accounts.

The object of Valdez is to navigate a supertanker from the North Pacific approximately 100 km. into the port of Valdez, Alaska. All of the important characteristics of a 300,000 ton supertanker have been accurately programmed into the simulation. In addition, a 64,000 point bit map is included.

All navigation must be done in relation to this map. This sounds easy. After all, all you have to do is tell the tanker when to turn and when to stop, right? Wrong! When I said that all of the characteristics of the tanker had been simulated I meant just that. Turning an object which weighs over 300,000 tons isn't done on a dime; neither is stopping or accelerating it. Momentum is one of the most important factors to be considered in the operation of this type of ship.

Once you have learned to control the ship through helm and engine commands, you must guide it through narrow passes into Valdez harbor. Once again this isn't as easy as it sounds for the computer is sailing other ships downstream from Valdez into the North Pacific. If you manage to dodge all of these ships, and there can be up to a dozen on the screen at any given time, you must then dodge the icebergs generated by the Columbia Glacier.

As if this isn't enough, you must take into account the tides in the area, which are quite strong and varied, and can have strange effects on your course.

Once you have made it into Valdez you must dock with the floating unloading station by bringing the ship to a dead stop with an accuracy of a few meters. As I said, it isn't as easy as it sounds!

The feel of the simulation is one of accuracy and authenticity. Never having piloted a real supertanker, I can't swear to that, but shortly before purchasing this simulation I read "Supership!" by Noel Mosterat, and the problems he discusses in the book all show up in the simulation—including the unreliable power plants!

It is obvious that someone has put a great deal of time and effort into Valdez and that it has paid off. On the whole, the results of interacting with this simulation have been an increased appreciation of the difficulties involved in operating this type of ship and several burned dinners as I have put off turning the hamburgers while trying "just one more round."

All of this isn't to say that the simulation is perfect. After all, no program is. There are several minor problems. The first is that the "play value" of the simulation has been somewhat neglected. For instance, there is no scenario at the beginning to set the scene. In addition the Apple II version that I have makes no use of the strong points of the Apple such as its sound and graphic capabilities. This is common with programs that have been developed for one system and translated into others. Apparently Valdez was developed on a Northstar system and translated to most others.

However, one of the nicest things about this program is that it can easily be modified to achieve the exact feel you want. Moving the opening down a few lines leaves room for a nice scenario and sound is easily added, even by a novice Applesoft programmer like me. Modifying the For/Next loops in lines 149 and 157, for example, can produce any radar effect that you want. My program has been modified to include both sound and variable radar scans, which make the simulation much more enjoyable for me. The only problem is that the wider scans take quite a while to display. I'm surprised that a short machine language program hasn't been incorporated here to speed up the display generation.

All in all Valdez is an excellent simulation and one of the few in this class that is available for all popular computers and on cassette. The best thing I can say about it is that it is exactly what I expected to be able to do when I bought my Apple a few months ago. I hope to see more such programs in the future—especially in cassette form. ☐

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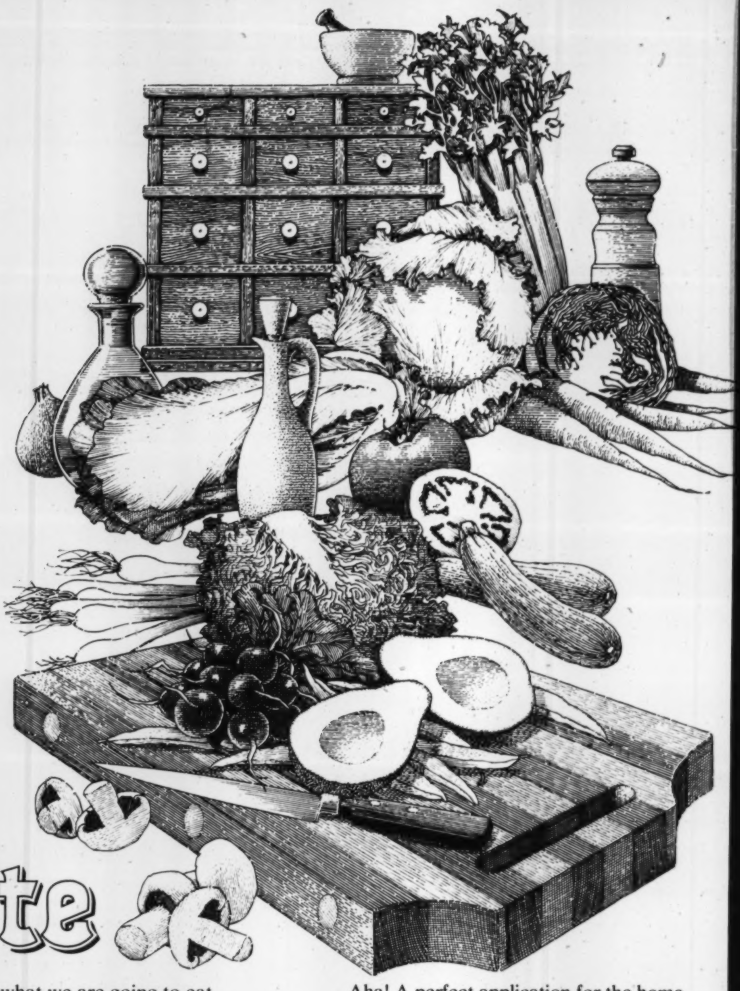

Stephen Kimmel

Better Nutrition Bite by Byte

If you want the computer to have an impact on the maximum number of people, then you have to pick a task that in some way affects the lives of many of them. In this frame of mind, I kicked off the sheets and blankets, poked Georgia in the ribs and asked her what the most common human activity was.

"Huh? What time is it?" she moaned, a model of erudition.

"Three o'clock. What's the most common human activity?"

"Sleep," my wife the dietitian and president-elect of the Oklahoma Dietetic Association said. She was unconscious again almost before she finished the word.

"Oh," I responded. I lay there thinking of some way for the computer to affect the way people sleep. As with breathing, I couldn't imagine a way for the computer to become involved in this undeniably common activity.

Eating is the most common human activity that involves any thought processes. Unlike breathing or sleeping, we have to decide what we are going to eat.

And for millions of Americans it isn't simply a matter of finding out what's in the refrigerator. Nearly 40% of all Americans are on some kind of diet. This includes about 5% on diabetic diets and an equal number on salt restricted diets for high blood pressure. Nearly a third of us are trying to lose weight. Look at your bookstore if you need more evidence. Look at the best seller lists. See how many diet books you find.

Eating is the most common human activity that involves any thought processes.

Aha! A perfect application for the home computer! Enrich the lives of millions by enabling them to take better control of their diets and hence their lives. Or is it?

Nutrition Is an Imprecise Science

Nutrition is a classic example of a field where precision doesn't matter. Consider a specific example; vitamin C in an orange. The nutrient tables will tell you to the nearest milligram what is contained in an average orange. One medium California Navel orange contains 85 milligrams of vitamin C. A Valencia orange has 59. Oranges from Florida contain an average of 68 milligrams. All of which is meaningless because oranges can range from a tiny 2" in diameter to a colossal 4". That means that two oranges of the same variety could vary as much in size as 800% with a corresponding variation in vitamin C content.

Actual content will vary according to the weather, the soil, and a thousand other factors. There are ways of telling exactly how much vitamin C there is in a specific orange. Unfortunately, the orange is inedible when the process is complete.

Stephen Kimmel, 4756 S. Irvington Place, Tulsa, OK 74135.

The Text Solution for APPLE II®

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Perhaps the most annoying shortcoming of the Apple II® is its limitation of displaying only 40 columns by 24 lines of text, all in uppercase. At last, Apple II® owners have a reliable, trouble-free answer to their text display problem. VIDEOTERM generates a full 80 columns by 24 lines of text, in upper and lower case. Twice the number of characters as the standard Apple II® display. And by utilizing a 7 by 9 character matrix, lower case letters have true descenders. But this is only the start.

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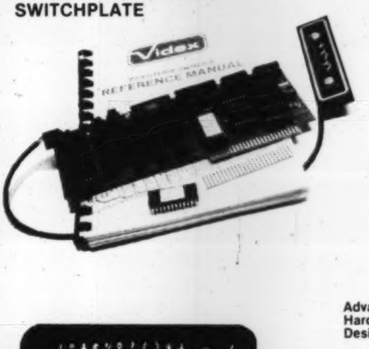


VIDEOTERM

BASICs VIDEOTERM lists BASIC programs, both Integer and Applesoft, using the entire 80 columns. Without splitting keywords. Full editing capabilities are offered using the ESCape key sequences for cursor movement. With provision for stop/start text scrolling utilizing the standard Control-S entry. And simultaneous on-screen display of text being printed.

Pascal Installation of VIDEOTERM in slot 3 provides Pascal immediate control of the display since Pascal recognizes the board as a standard video display terminal and treats it as such. No changes are needed to Pascal's MISC.INFO or GOTOXY files, although customization directions are provided. All cursor control characters are identical to standard Pascal defaults.

Other Boards The new Microsoft Softcard* is supported. So is the popular D. C. Hayes Micromodem II*, utilizing customized PROM firmware available from VIDEX. The powerful EasyWriter* Professional Word Processing System and other word processors are now compatible with VIDEOTERM. Or use the Mountain Hardware ROMWriter* (or other PROM programmer) to generate your own custom character sets. Naturally, VIDEOTERM conforms to all Apple OEM guidelines, assurance that you will have no conflicts with current or future Apple II* expansion boards.

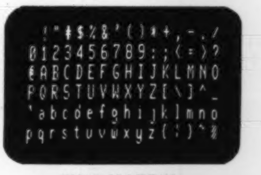
Advanced Hardware Design VIDEOTERM's on-board asynchronous crystal clock ensures flicker-free character display. Only the size of the Pascal Language card, VIDEOTERM utilizes CMOS and low power consumption ICs, ensuring cool, reliable operation. All ICs are fully socketed for easy maintenance. Add to that 2K of on-board RAM, 50 or 60 Hz operation, and provision of power and input connectors for a light pen. Problems are designed out, not in.

Available Options The entire display may be altered to inverse video, displaying black characters on a white field. PROMs containing alternate character sets and graphic symbols are available from Videx. A switchplate option allows you to use the same video monitor for either the VIDEOTERM or the standard Apple II* display, instantly changing displays by flipping a single toggle switch. The switchplate assembly inserts into one of the rear cut-outs in the Apple II* case so that the toggle switch is readily accessible. And the Videx KEYBOARD ENHANCER can be installed, allowing upper and lower case character entry directly from your Apple II* keyboard.

Firmware 1K of on-board ROM firmware controls all operation of the VIDEOTERM. No machine language patches are needed for normal VIDEOTERM use.

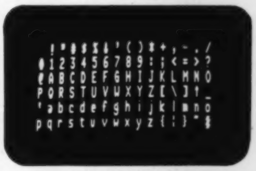
Firmware Version 2.0

Characters	7 x 9 matrix	Display	24 x 80 (full descenders)
Options	7 x 12 matrix option; Alternate user definable character set option; Inverse video option.		18 x 80 (7 x 12 matrix with full descenders)



```
 !"#$%&'()*+,-./
0123456789:;<=>?
@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]^_
`abcdefghijklmno
pqrstuvwxyz{|}~
```

7X12 MATRIX
18X80 OPTIONAL



```
 !"#$%&'()*+,-./
0123456789:;<=>?
@ABCDEFGHIJKLMNO
PQRSTUVWXYZ[\]↑_
`abcdefghijklmno
pqrstuvwxyz{|}~
```

7X9 MATRIX
24X80 STANDARD

Want to know more? Contact your local Apple dealer today for a demonstration. VIDEOTERM is available through your local dealer or direct from Videx in Corvallis, Oregon. Or send for the VIDEOTERM Owners Reference Manual and deduct the amount if you decide to purchase. Upgrade your Apple II* to full terminal capabilities for half the cost of a terminal. VIDEOTERM. At last.

Apple II* is a trademark of Apple Computer Inc.
ROMWriter* is a trademark of Mountain Hardware Inc.
Micromodem II* is a trademark of D. C. Hayes Associates Inc.
Softcard* is a trademark of Microsoft
EasyWriter* is a trademark of Information Unlimited Software Inc.

PRICE:
- **VIDEOTERM includes manual $345**
- **SWITCHPLATE .... $ 19**
- **MANUAL refund with purchase .... $ 19**
- **7 x 12 CHARACTER SET .... $ 39**
- **MICROMODEM FIRMWARE ...... $ 25**

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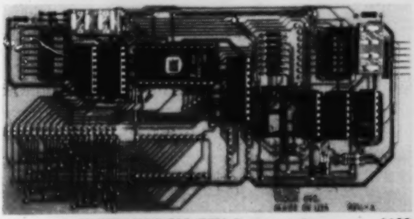
Videx has the perfect companion for your word processor software: the **KEYBOARD AND DISPLAY ENHANCER**. Install the enhancer in your APPLE II and be typing in lower case just like a typewriter. If you want an upper case character, use the SHIFT key or the CTRL key for shift lock. Not only that, but you see upper and lower case on the screen as you type. Perfectly compatible with Apple Writer and other word processors like, for example, Super-Text.

If you want to program in BASIC, just put it back into the alpha lock mode; and you have the original keyboard back with a few improvements. Now you can enter those elusive 9 characters directly from the keyboard, or require the Control key to be pressed with the RESET to prevent accidental resets.

KEYBOARD AND DISPLAY ENHANCER is recommended for use with all revisions of the APPLE II. It includes 6 ICs, and EPROM and dip-switches mounted on a PC board, and a jumper cable. Easy installation, meaning no soldering or cutting traces. Alternate default modes are dip-switch selectable. You can even remap the keyboard, selecting an alternate character set, for custom applications.



PRICE • KDE-700 (REV. 7 or greater) .... $129.
• KDE-000 (REV. 6 or less) .... $129.

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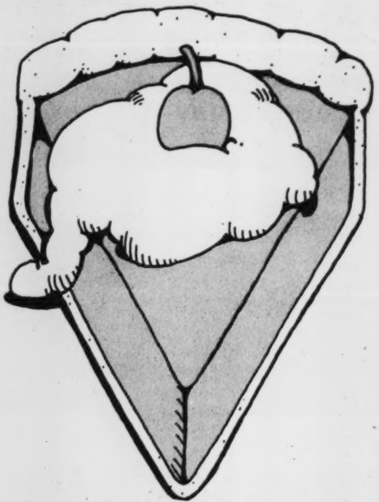
Videx

VIDEX
897 N.W. Grant Avenue
Corvallis, Oregon 97330
Phone (503) 758-0521

CIRCLE 240 ON READER SERVICE CARD



Fortunately, the fact that accuracy is impossible is unimportant. The body is a remarkably efficient chemical factory. If you eat too much of something, then the body will save it; as it does when it stores vitamin D in fat tissue; convert it to something else, protein to glucose and fat (Almost all Americans eat too much protein); or throw it away, as it does with excess iron. If, perchance, you don't eat enough of something, the body will take it out of storage, make it out of something else if it can, or simply do without it for a while.

It is difficult, at best, to determine what a human needs to consume. It depends on his metabolic rates, his particular body chemistry and his weight. Anyone who believes that accuracy in this field is possible is invited to tell me to the nearest gram what he weighs—and converting your weight from a bathroom scale doesn't count since it is only accurate to the nearest pound. Maybe. The point is that it is absolutely impossible to say exactly what any individual needs to consume.

It is impossible to know precisely what you eat, and equally impossible to know precisely what you need to eat. Your response to this fact of life is to eat a variety of foods every day. The surest way to become malnourished is to eat the same thing every day for a prolonged period of time. The surest way to maintain good nutrition is to eat a wide variety of foods, including breads, meats, vegetables, fats, and fruits.

Enter the Computer

This may make it sound as if there is no need for computer programs. Not quite true. There is growing awareness of the importance of nutrition; even doctors are beginning to take nutritional considerations seriously. Few human activities have as much potential to improve the quality of our lives as eating well.

Nutrition calculations, however, while simple, are tedious and time consuming. Not surprisingly there is a great deal of activity in this field. It is comparable to anything except accounting and games, with at least fifty programs in use, under development and/or for sale in America. Now look through the ads in this magazine. Where are all the diet programs?

Almost every hospital and every school with a nutrition curriculum has a diet program running on its computer system—typically the Megalith 5000 series machine—and almost all were developed in-house. So there are programs out there, and there are people writing diet programs.

Why, then, are there so few for small computers? A fair question and one that I asked myself frequently in preparing this article. The answer lies in the fact that most of the programs were written by people who suffered from Big Computer Psychosis.

Big Computer Psychosis, as we all know, is a horrible malady that afflicts people who have a moderate working knowledge of some so-called "main frame computer." They can be instantly identified by their use of the phrase, "That'll never fit on a microcomputer." Their logic runs like this: "I had a hell of a time getting this on my $100,000 computer. It just barely fits. I don't know much about microcomputers, but I know they're smaller than my computer. Therefore, it will never fit on a microcomputer." Wonderful logic. Also very wrong.

There is growing awareness of the importance of nutrition.

Texas Tech University, like most large schools, has a Department of Food and Nutrition within its college of Home Economics. (That is certainly an artifact of the days when medical people thought nutrition had little to do with an individual's health and dietitians were fat old ladies.)

Texas Tech's diet program is called, cleverly enough, DIET. It is available as a deck of cards (740 for the program, 647 for the data base) for duplication costs.

DIET is written in Cobol and executed on an IBM 370/145. It was designed for nutrition students to use in performing detailed analyses on one or more days of meals. The student enters the quantity and the food eaten and the program computes the quantity of each of 28 nutrients consumed during the time period. The Texas Tech program, which is one of the best, contains 626 foods and 28 nutrients. That's quite a bit of information.

It is easy to see why a diet program would be difficult to fit on a computer of any size. Basically, a diet program is very little more than a database manipulator. The essential mathematics are very simple. You multiply the nutritional content of a given food by the amount eaten, add the results to the other foods eaten during a given time period and compare the total to the recommended daily allowance (RDA). The program isn't much. It is the data base that consumes all the memory.

As a rule of thumb you need at least 100 foods to even begin to do a reasonable job of simulating an American diet. The question is how many nutrients and qualities you want to maintain for each. Suppose you have 20 nutrients for each of 300 foods and you store them as floating point variables. Further assume that each food has a twelve-letter name. Without even blinking you've used up nearly 28000 bytes. Then if you use data statements to put the information into memory, you've used up that number again. Now you've consumed 56000 bytes, more than most personal computers have available. And you still haven't determined the individual's RDA.

Your choice, then, is fewer foods or fewer nutrients or better programming. Since most of the creators of large programs have large computers, they choose the brute force approach. Small wonder they don't think a home computer can do the job.

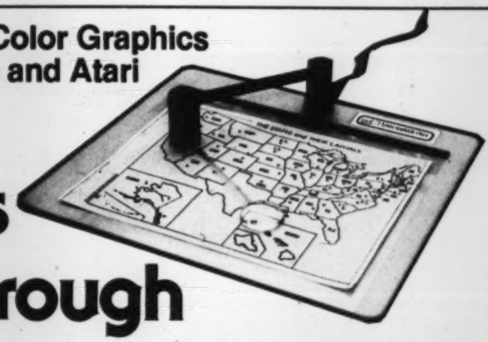
Contrary to the opinion common among programmers working on large machines, the small computer is fully capable of doing the job. Some of these programs, I found, do the job better than the monsters. In this article I will review a few of the programs available. Some are magnificent efforts. Some are simply funny.

Diet Information Program

The first of our programs is in Dwyer and Critchfield's "Basic and the Personal Computer." Diet Information Program was originally designed as a practical example of a data base program. It includes 28 foods and 18 nutrients—too few to be of any practical use. Pick 28 foods, any 28 foods, and eat nothing else. If you stick to it for over a week, write and tell me what you ate.

Indeed, the authors really have illustrative purposes in mind and the program wasn't meant to be used. It performs the most fundamental task of a diet program: you input a group of foods and the program tells you how that compares with your requirements. It you were unable to find anything better, you can easily expand

High-Resolution Color Graphics for the Apple and Atari



Graphics Breakthrough

How many programs have you written that would benefit from animated high-resolution graphics? Probably several. It is this kind of dramatic graphics that distinguish outstanding programs from ordinary ones. But if you've ever agonized for hours or days just to get one image perfected, you're probably not anxious to do it again. Now there's a better way.

New Graphics Entry System

Today there is a new graphics system available that is not only amazingly user-oriented but surprisingly economical. Called VersaWriter, it starts with an ingeniously simple entry board consisting of a 14" X 12" high impact plastic bed with a tough clear plastic overlay sheet. The original drawing or diagram is fastened with masking tape to the plastic bed and then covered with the clear sheet. Instead of using a light pen or complicated electronic X-Y head, the VersaWriter uses a double jointed arm attached to the top of the entry board at one end and a magnifying lens with crosshairs at the other end. The VersaWriter resembles a draftsman's pantograph on a smaller scale.

At each joint in the arm of the VersaWriter is a potentiometer. A cable from these pontentiometers connects to the paddle input of the computer. No special interface electronics or board is needed. Since the arm of the VersaWriter bends only in one direction, each point on the plotting head corresponds to a unique set of resistances on the potentiometers. All that's needed now is software to translate these resistances into usable screen coordinates.

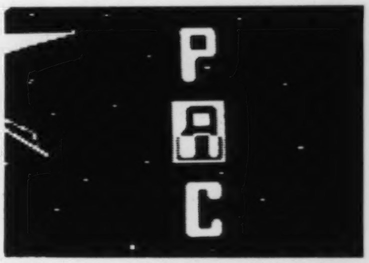
Exceptionally powerful software

It is in the software where VersaWriter really stands out. VersaWriter comes with two full disks of user-oriented software. First it has sets of "low level" commands for entering, creating and copying drawings and diagrams. Secondly, it has extensive sets of application routines for moving, enlarging, rotating, coloring or animating drawings that the user has created.

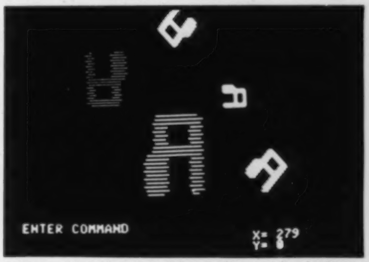
Graphics Systems

Versa Writer	**$249.00**
Kurta Graphics Tablet	**695.00**
Summagraphics Digitizer	**745.00**
Houston Instruments Hi Pad	**795.00**
Apple Graphics Tablet	**795.00**

Of course the basic commands let you enter a drawing freehand or by tracing it. Want a wider brush stroke? Six widths are available. Drawings can be independently scaled in both the vertical and horizontal directions. An enclosed shape may be filled in with any of 106 colors. No, that is not a misprint—By the same technique that a printing press can create hundreds of colors from the three primary ones, so can VersaWriter.



Here a shape (the letter A) is being scanned. After putting it in a shape table it may be used in other programs.



```
ENTER COMMAND
X= 279
Y= 8
```

From the shape table, a shape (the letter A) may be enlarged, rotated, colored or moved about the screen.

Create Animation for Other Programs

The shapes you create with VersaWriter can be used and manipulated with ease in other programs. Up to 255 shapes can be entered into a shape table. These shapes may then be placed on the screen in any position or may be overlaid on a full or partial screen image. Animation is produced easily by moving about a portion of the image created by VersaWriter. For example, by alternating between two images of an airplane propeller it will appear to be spinning.

Other VersaWriter software includes text-writer with which text can be added to graphics. Upper and lower case, choice of color, text size, direction and starting point all may be specified.

The Area/Distance program lets you calculate distances (or perimeters) by entering a scale and tracing a shape or map route with the drawing arm. Areas of figures, open and irregular, can be similarly calculated.

The software also includes sets of electronic and computer logic shapes. In addition, an entire disk of dramatic demonstration graphics is included. These twelve full-screen graphics run the gamut from a fully labeled cross section of a human skull to colored maps to animated cartoons to an electronics schematic.

Software Updates

You may have read a review of VersaWriter that indicated that the color fill routine was slow. It was. But not any more. Several routines and improvements were added to the VersaWriter software since its introduction. An added feature, the Expansion Pac, is also now available. This third disk of software contains an area distance program, a microscope feature, and will save your graphics in the exact colors you prefer. It also includes shape tables for architecture, plumbing, electrical, circuit boards, landscape, chemistry, games, and more; 350 predefined shapes in all.

At Peripherals Plus, we evaluated every graphics device. We wanted to handle the best one regardless of price. VersaWriter has the best performance bar none. Surprisingly, it also has the lowest price, just $299.00 for the Apple version. It requires an Apple II Applesoft in Rom (or an Apple II Plus), disk, and 48K memory. VersaWriter comes complete with two disks of software, a comprehensive instruction manual, and a 90-day limited warranty. The additional Expansion Pac is available for $39.95.

The Atari version, which varies slightly from the Apple version in number and types of functions performed, is available for $299.00. As new updates are developed for the Atari, Peripherals Plus will furnish them free to all customers—just send us the disk and we'll supply the updated material. We make this unique offer because it is in our best interest to have you make the best use of your computer. We're also convinced that if other people see your VersaWriter in use they'll want one too.

Try VersaWriter for 30 days. If you are not completely satisfied we'll give you a prompt and courteous refund of the full price plus shipping both ways.

To order, specify Apple or Atari version, send payment plus $3.00 shipping and handling to Peripherals Plus, 39 East Hanover Ave., Morris Plains, NJ 07950. (New Jersey residents please add 5% Sales tax.) Credit card customers should include card number and expiration date of Visa, MasterCard or American Express card. Credit card customers may also call toll-free 800-631-8112 (in NJ 201-540-0445).

For spectacular graphics on your computer, order VersaWriter today.

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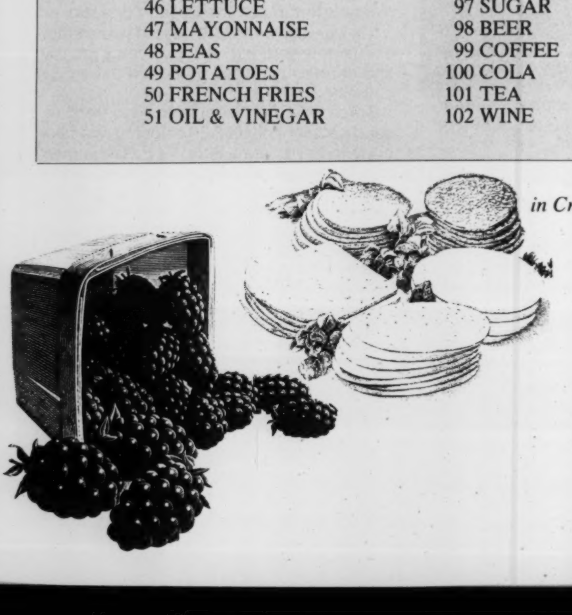
1 BACON
2 BOUILLON
3 CORNED BEEF
4 ROAST BEEF
5 BOLOGNA
6 CHICKEN
7 FLOUNDER
8 FRANKFURTER
9 HAM
10 HAMBURGER
11 LIVER
12 PORK CHOP
13 SALMON
14 SAUSAGE
15 TUNA
16 TURKEY
17 VEAL
18 BEEF STEW
19 PEANUT BUTTER
20 PIZZA
21 CREAMED SOUP
22 TOMATO SOUP
23 VEGETABLE SOUP
24 SOYBEANS
25 SPAGHETTI
26 BUTTER
27 CHEDDAR CHEESE
28 COTTAGE CHEESE
29 CREAM CHEESE
30 SWISS CHEESE
31 CREAM
32 EGG
33 MARGARINE
34 WHOLE MILK
35 SKIM MILK
36 MALTED MILK
37 YOGURT
38 BAKED BEANS
39 LIMA BEANS
40 GREEN BEANS
41 BEETS
42 BROCCOLI
43 CARROTS
44 COOKED CARROTS
45 CORN
46 LETTUCE
47 MAYONNAISE
48 PEAS
49 POTATOES
50 FRENCH FRIES
51 OIL & VINEGAR
52 SALAD DRESSING
53 SPINACH
54 BISCUIT
55 WHITE BREAD
56 WHEAT BREAD
57 CORNFLAKES
58 GRAHAM CRACKER
59 CRACKER
60 FLOUR
61 PASTA
62 OATMEAL
63 PANCAKE
64 RAISIN BRAN
65 WHITE RICE
66 BROWN RICE
67 WHEAT GERM
68 APPLE
69 BANANA
70 CANTALOUPE
71 CUCUMBER
72 GRAPEFRUIT
73 GRAPES
74 ORANGE
75 ORANGE JUICE
76 PEACHES
77 PINEAPPLE
78 RAISINS
79 STRAWBERRIES
80 TOMATO
81 WATERMELON
82 CAKE
83 CANDY
84 CHOCOLATE
85 SANDWICH COOKIES
86 DOUGHNUT
87 GELATIN
88 HONEY
89 ICE CREAM
90 JAM/JELLY
91 PEANUTS
92 CUSTARD PIE
93 FRUIT PIE
94 POPCORN
95 POTATO CHIP
96 PUDDING
97 SUGAR
98 BEER
99 COFFEE
100 COLA
101 TEA
102 WINE

Figure 1. List of Foods in Creative Computing's Diet.



the number of foods. The authors list several fine sources of additional data where you can find additional food numbers to enter in your program.

Still, you will run out of memory quickly, since the running program has the data as both statements in the program and as data. Very fundamental. Don't bother. There are programs available that will do the job.

Diet

Diet, by Creative Computing Software as part of Ecology Simulations-2, is one that will do the job. It is one of four programs designed for classroom use. It is an interesting combination: pollution control, rat control, disease control and fat control. Here we have the minimum 100 foods and only four nutrients for each. However the four nutrients are the most fundamental, protein, fat, carbohydrates, and calories—if you want to fall into the fallacy of thinking of a calorie as a nutrient.

The program implies the "wide variety" concept of nutrition. If you eat a wide enough variety you would pick up the required vitamins and minerals. The Creative Computing program isn't really designed for home use. It is geared toward classroom application and instruction. The student enters what he has eaten for breakfast, lunch, dinner and a snack and the program tells him how close he has come to meeting his daily needs. It does a reasonably good job.

Quick. What did you have for lunch yesterday?

To use Diet in the home environment will require few modifications. It can be used to design a workable diet and will project how much you can expect to lose or gain if you stick to a prescribed diet. It might have been better if it allowed you to adjust your menu on-line and gave you a continuous update on how the foods you had selected so far compared with the prescribed quantities. These are fairly simple modifications and well within the abilities of most programmers.

The program really needs a printed sheet to go with it so the user can record what he eats, or plans to eat. To help you, Figure 1 provides a list of the foods in the Diet database. Make copies of it and use it to record what you eat as you eat it. The ability to recall what you have eaten in the last 24 hours is frequently shaky. Quick. What did you have for lunch yester-

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for the Apple II

You bought your Apple for its graphics capabilities. Now with the **A2-GE1**, you can use those capabilities to the fullest.

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You can also record your entire presentation, animation and all, for later use with **Motion Playback**, or just take "computer snapshots" of scenes with **Slide Show Playback**.

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75
77
79
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A2-3D1 Graphics Package
$59.95 on disk (32K required)

A2-3D2 Enhancement
for color and independent object manipulation
$24.95 on disk (48K and A2-3D1 required)

A2-3D/A Saturn Navigator
a 3D adventure program
$24.95 on disk (48K, A2-3D1, and Applesoft in ROM required)

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CIRCLE 187 ON READER SERVICE CARD

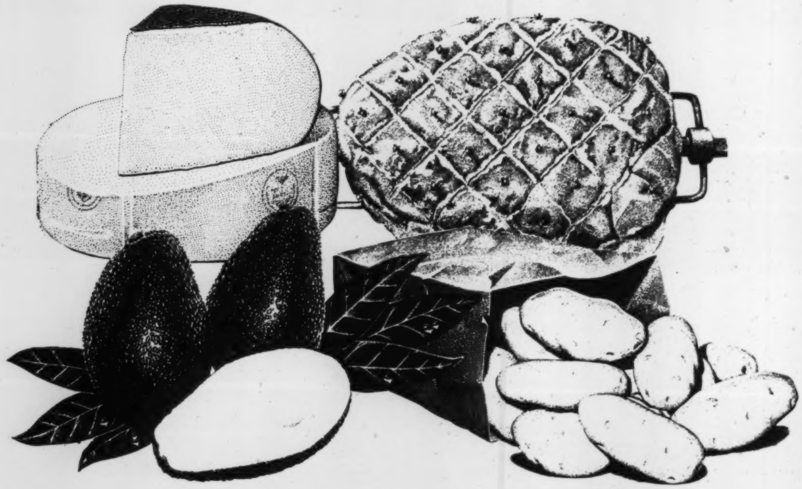
```
                         BREAKFAST MENU

                                                  2100 Calories
Serving Unit                                      Number of Servings
2 slices lunchmeat                                1 2/3
1/2 cup cooked cereal                             1 2/3
1 cup low fat milk (or buttermilk or yogurt)      1 2/3
1/8 avocado                                       1 2/3
12 grapes                                         1 2/3
tea or coffee (no sugar) or bouillon              1
         Select: 1-Different Foods or 2-Return to Meal Menu

                           LUNCH MENU
                                                  2100 Calories
Serving Unit                                      Number of Servings
2 eggs                                            1 2/3
1/2 cup rice                                      1 2/3
2 tsp. French dressing                            1 2/3
1 cup low fat milk (or buttermilk or yogurt)      1 2/3
1 small orange                                    1 2/3
pickles (not sweetened)                           1
         Select: 1-Different Foods or 2-Return to Meal Menu

                          DINNER MENU
                                                  2100 Calories
Serving Unit                                      Number of Servings
2 eggs                                            1 2/3
1/2 cup cooked spaghetti or noodles               1 2/3
1 cup cabbage                                     1 2/3
10 cherries                                       1 2/3
pickles (not sweetened)                           1
         Select: 1-Different Foods or 2-Return to Meal Menu
```

Figure 2. Sample Menus Produced by Flexidiet.



day? How many ounces of milk did you drink yesterday? Was it whole, 2% or skim milk? For the diet program to do its job right, it has to know precisely what and how much of it you have eaten. Unfortunately, people don't drink five ounces of milk. They drink a big glass or a little glass. Once again we see the impossibility of accuracy. That's the major problem with our next program.

Flexidiet

Flexidiet is a part of the Body Buddy package for the TRS-80 from Instant Software. Hmmm. Instant Software—instant food. Could I be so rude as to draw an analogy here? After all, we all know how good instant food is. Some of it is adequate. An author of high principles certainly wouldn't take a cheap shot like that. A lot of Instant Software's programs are adequate. Flexidiet isn't one of them. Flexidiet is an . . . uh . . . attempt at solving the problem of home use. It has an apparent 88 foods, but these are far too few since most of them are vegetables. Flexidiet, unlike the other programs, is a menu planning program. You designate a calorie level and a meal, and Flexidiet prints a suggested menu.

Flexidiet solves the memory consumption problem in a unique way. Each food is assigned to an exchange grouping. All fruits, for example, are grouped together. A serving of each food in the grouping has approximately the same number of the four basic nutrients and, in theory, can be exchanged for another in the group.

The specific food doesn't matter, since the quantity of the foods on the exchange are designed to equalize the major nutrients. If you are allowed one milk exchange it doesn't matter if you have 1 cup of skim milk, 1/2 cup of cottage cheese or 1 cup of unflavored yogurt. They can be readily exchanged for one another. Flexidiet indicates which food belongs to which exchange group with an index. Thus the program contains no data at all on how much of each nutrient a food contains.

The program plans the meals by following the old diabetic diet exchange system which is very similar to the Weight Watchers and TOPS systems. Each meal is allowed a certain number of each type of exchange. Breakfast, for example, might have one milk exchange, two fruits, one meat and two fat exchanges.

Flexidiet contains a meal pattern that tells it which exchanges are allowed and then, you guessed it, it randomly selects a food with the correct exchange designation. Now comes the problem which should be readily apparent to everyone: some combinations of foods simply don't go together. Figure 2, a print out of a Flexidiet menu, demonstrates that.

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CIRCLE 307 ON READER SERVICE CARD

Bite by Byte, continued...

Flexidiet, not satisfied with one bad idea, compounds it with another. The program contains a single diet plan. Other calorie levels are obtained by simply multiplying the base pattern. For example, a 2100 calorie diet is 1 2/3 of the base 1200 calorie diet. The mixed fractions this creates are a nightmare. Quickly, and exactly, everyone go slice up 1 2/3 of 1/8 of an avocado. I'll give partial credit to anyone who can figure out how much of an avocado that is.

Of the entire group, Flexidiet was the funniest of the programs. My wife and I laughed until we cried trying to get reasonable combinations of foods. This gobbler is completely worthless except as an ice breaker at parties. Nice try, Instant Software. Go to the back of the class.

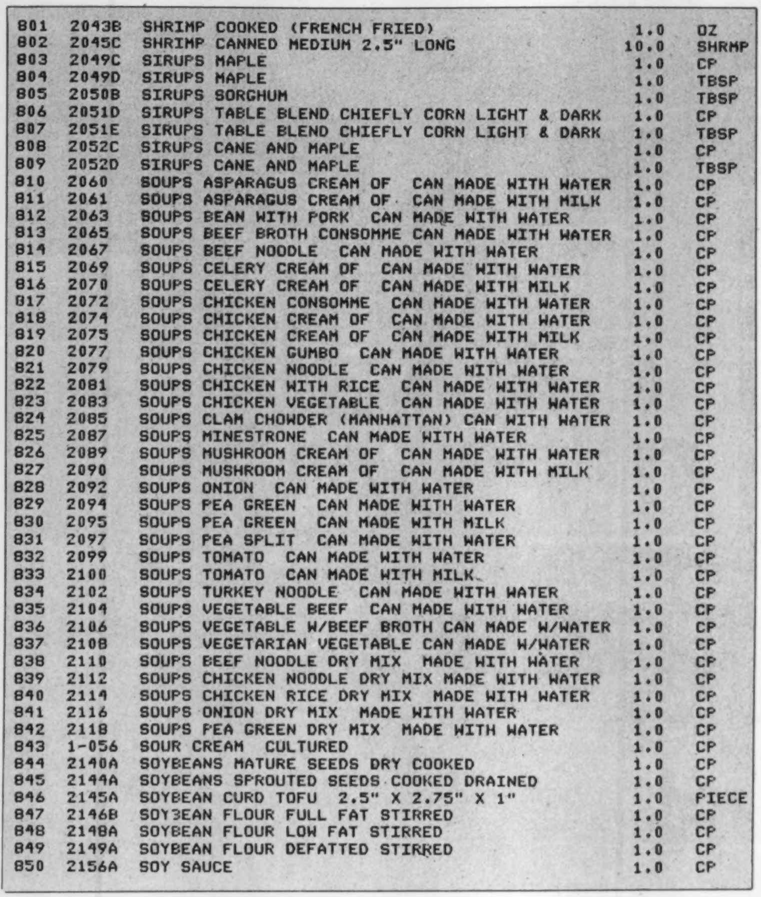
Flexidiet was the funniest of the programs.

One vast improvement in your programming would be to avoid the double whammy of having all the information in the computer twice. Douglas Green's Diet program, which appeared in November 1980 *Creative Computing*, handles the database as an external file which is all loaded into memory once from a cassette or disk file. That program lists 97 foods and seven nutrients—apparently an adequate number of both. It is a put-in-the-foods, get-out-the-analysis program similar to most of what is done in the field. Here, unlike Creative Computing's Diet program, the foods aren't set up as meals, a fact which does make the program somewhat awkward to use. Again the needed modifications are well within the scope of any programmer who can translate the program to his machine. The program was written for the Wang system 2000; translation isn't simple.

Compudiet

One of the best programs, and certainly one of the most obscure, is Compudiet by Information Technology Systems. The program is designed to work on a 16K TRS-80. My current version has 127 foods and 13 nutrients in its database. Compudiet 1.4, which has an uncertain release date, is said to contain 200 foods and 20 nutrients, and will be comparable to many of the programs the "Big Computer Psychosis" people have.

It overcomes the database problem with another program which is definitely available. BASICIO, also from Information Technology Systems, is a machine language program that is built into other programs and performs what amounts to a core image dump and retrieval with the cassette. The data is dumped exactly as it appears in the computer. It saves and loads a huge array of data very quickly and with maximum economy of both memory and tape.



```
801  2043B  SHRIMP COOKED (FRENCH FRIED)                     1.0   OZ
802  2045C  SHRIMP CANNED MEDIUM 2.5" LONG                  10.0   SHRMP
803  2049C  SIRUPS MAPLE                                     1.0   CP
804  2049D  SIRUPS MAPLE                                     1.0   TBSP
805  2050B  SIRUPS SORGHUM                                   1.0   TBSP
806  2051D  SIRUPS TABLE BLEND CHIEFLY CORN LIGHT & DARK     1.0   CP
807  2051E  SIRUPS TABLE BLEND CHIEFLY CORN LIGHT & DARK     1.0   TBSP
808  2052C  SIRUPS CANE AND MAPLE                            1.0   CP
809  2052D  SIRUPS CANE AND MAPLE                            1.0   TBSP
810  2060   SOUPS ASPARAGUS CREAM OF  CAN MADE WITH WATER    1.0   CP
811  2061   SOUPS ASPARAGUS CREAM OF  CAN MADE WITH MILK     1.0   CP
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840  2114   SOUPS CHICKEN RICE DRY MIX  MADE WITH WATER      1.0   CP
841  2116   SOUPS ONION DRY MIX  MADE WITH WATER             1.0   CP
842  2118   SOUPS PEA GREEN DRY MIX  MADE WITH WATER         1.0   CP
843  1-056  SOUR CREAM  CULTURED                             1.0   CP
844  2140A  SOYBEANS MATURE SEEDS DRY COOKED                 1.0   CP
845  2144A  SOYBEANS SPROUTED SEEDS COOKED DRAINED           1.0   CP
846  2145A  SOYBEAN CURD TOFU  2.5" X 2.75" X 1"             1.0   PIECE
847  2146B  SOY3EAN FLOUR FULL FAT STIRRED                   1.0   CP
848  2148A  SOYBEAN FLOUR LOW FAT STIRRED                    1.0   CP
849  2149A  SOYBEAN FLOUR DEFATTED STIRRED                   1.0   CP
850  2156A  SOY SAUCE                                        1.0   CP
```

Figure 3. Datadiet Database.

Why haven't you heard of Compudiet? Because Information Technology Systems doesn't have the economic resources of Instant Software.

What makes Compudiet such a great program isn't the fact that it loads faster than anyone else's program or that it has a large database. No, the real strength of Compudiet is that the author recognizes the fact that the computer and nutrition analysis are only a part of the total weight loss system. Compudiet comes with a dieter's manual (!) that is designed to help you identify the whys and wherefores of your eating. It addresses the issue of whether you eat when you are nervous or bored or lonely. Only Compudiet is concerned with the reason for a weight problem, and of the group, Compudiet has the best chance of helping you lose weight.

But, alas, the program may no longer be available. Such is justice.

Datadiet

So far we have seen nothing to really stir the big guys from their conviction that the task is too big for a home computer. Compudiet, they say smilingly, is a nice try but horribly limited. Well, boys and girls, that's about to change.

Out in California is a bunch of folks who will make all these people stand up and take notice. There is a program that would show these people that a small computer can do anything the big ones can do. IPC Datadiet has a program called Datadiet (don't you love the originality in this field?) that contains 1000 foods (expandable to 1500) and 14 nutrients. That's more foods than almost any of the megalith programs. It is designed to operate on a 48K TRS-80 with two 35-track single density disk drives. Fifteen hundred foods with 14 nutrients and a long name? How do you get all that into a small computer at once? Simple. You don't. You bring whatever data you need from the disk and you leave the rest safely out of memory. Thus, you can have a couple thousand foods available to you and still have some room for your program.

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CIRCLE 263 ON READER SERVICE CARD

Bite by Byte, continued...

Datadiet wasn't designed with the home user in mind. It was written to serve professional dietitians and physicians. No home user needs the kind of power available through the Datadiet system. The system appears to be capable of coping with a hospital dietitian's entire work load. Of course, this program doesn't come cheap. Datadiet sells for $399 to users who don't require special consultant help, which shouldn't be necessary since the instructions are amazingly clear and easy to follow. This is a fully professional program and while the price tag seems a little steep to me it is in line with the sort of accounting software that is suitable for major commercial purposes. Figure 3 is a listing of a small portion of the database in Datadiet.

IPC Datadiet has two other programs currently available which are also designed for the nutrition professional. Recall24 uses a much smaller database than Datadiet with just 54 foods. However, using the exchange system it offers an effective 170 foods. When you use the exchange system you can't get much more than protein, fat and carbohydrates although Recall24 does include cholesterol too.

Datadiet wasn't designed with the home user in mind.

Recall24 has the best fully interactive menu evaluation I've seen, giving running totals of each nutrient. The program calculates your current diet according to sex, age, and activity level. After entering what you have eaten in the last 24 hours (a 24 hour recall), the program evaluates what you have eaten by food groups. Again, this is a fully professional program (that is suitable for home use) and you pay for it. Recall24 goes for $160.

Fastfood is, by comparison, dirt cheap at $35 and is essentially identical to Recall24, except for the diet evaluation. The foods in the Fastfood database are—I assume everybody has already guessed—50 of the most common fast foods, ranging from Egg McMuffin to Kentucky Fried Chicken. The reason that Fastfood is so much cheaper is that it is much less useful.

IPC Datadiet plans to get into the home market with Home Nutrition Guide, which will cost about $35 and have the Recall24 database. Unfortunately it will lack the evaluation portion of the program—the worst thing they could have cut out.

The following is a partial list of computer programs available that relate to diet.

Diet
Classroom Instruction
Creative Computing
P.O. Box 789-M
Morristown, NJ 07960 $24.95

Flexidiet
Party Game/Weight Loss
Instant Software
Peterborough, NH 03458 $9.95

Compudiet
Weight Loss
Information Technology Systems
P.O. Box 2667
Sarasota, FL 33578 $19.95

Recall24
Medical Professional
IPC Datadiet
P.O. Box 28156
San Jose, CA 95125 $160

Datadiet
Medical Professional
Same as above $399

Fast Food
Same as above $35

The following programs are in use at major institutions. Interested readers should check with the institution concerning system requirements and availability.

Mini List Computerized Nutritional Analysis
University of California at Berkeley
Department of Nutritional Science
Database contains 235 foods, 50 nutrients, $75
Contact: Janet C. King, Ph.D.

DIANA (Dietary Analysis)
Los Angeles Valley College
Family and Consumer Studies Department
Database contains 635 foods, 10 nutrients, Price on request
Contact: Ida Jaqua

Little Falls Hospital
Clinton, NY 13323, $3000
Contact: Mary E. Kilby, RD

FOINANA, User's Guide to Food $, and LEAN
University of Minnesota
Agricultural Extension Service
St. Paul, MN $25-$100
Contact: Muriel S. Brink, Extension Nutritionist

Pillsbury's Computerized Nutrition Exhibit
Pillsbury Company
Minneapolis, MN
Contact: Marlene A. Johnson, Consumer Relations

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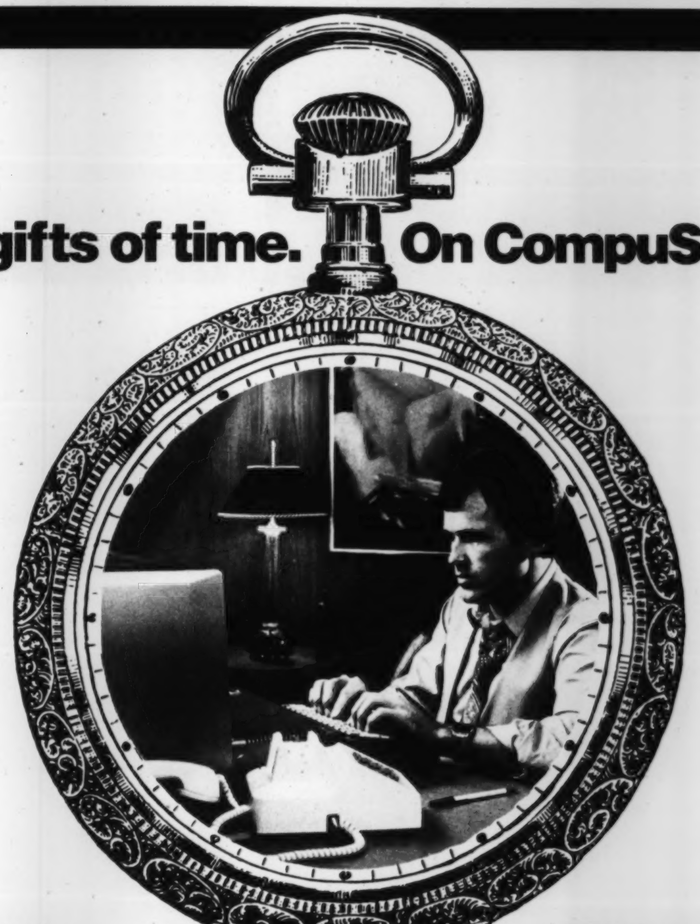

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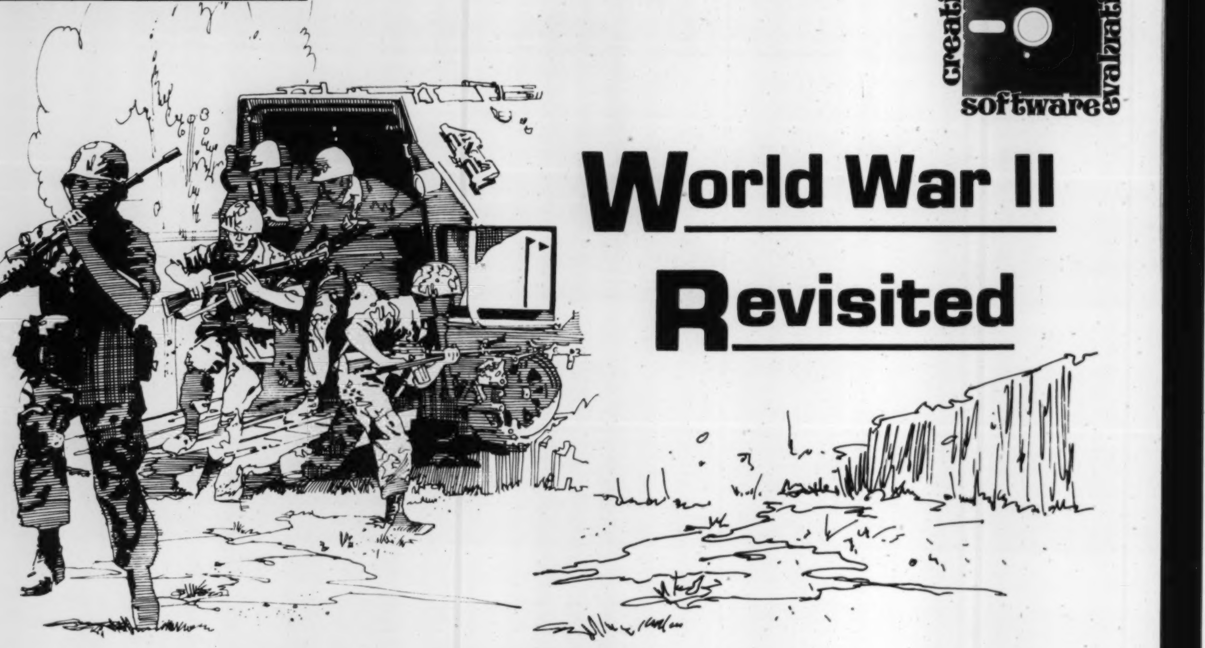
CIRCLE 209 ON READER SERVICE CARD

creative computing software evaluation



World War II Revisited

George Miller

Games are an abstraction of reality. One of the simplest games is the Oriental game of Go which is a fight for territory. The rules of Chess are more complex than Go and the game more closely resembles a battlefield. The microcomputer allows the submersion of rules in the bowels of a program and frees the participant from the details allowing him to concentrate on clever strategies and sweeping plans of attack.

Strategic Simulations has introduced a new computer game called Operation Apocalypse which simulates major World War II land operations. It requires a 48K Apple II with Applesoft ROM Card or an Apple II Plus and one disk drive. The game is actually four games in one since it has four different scenarios representing four different WWII battle operations.

The battlefield is laid out before the players on the Apple screen. Battle movements are shown in color as tanks and troops march across the terrain and the sounds of battle are heard as the artillery is fired or forces engage in combat.

My only previous contacts with war-gaming were Risk, Diplomacy, and Stratego, parlor games played with markers on a board (if you don't remember, ask your father). I seem to have stepped into the latest rendition of a genre unknown to all but a fanatical group of war-gaming freaks. One reason you have to be fanatical to be a war-gamer is that it ofen takes a great deal of time to learn the rules and play the game. The computer changes all of that.

creative computing
SOFTWARE PROFILE

Name: Operation Apocalypse
Type: War
System: 48K Apple with Applesoft, Disk Drive
Format: Disk
Language: Applesoft
Summary: Excellent
Price: $59.95
Manufacturer:
Strategic Simulations, Inc.
450 San Antonio Road, Suite 62
Palo Alto, CA 94306

The most complicated part of the Operation Apocalypse rules is listed in an appendix as the combat resolution tables. The players need not read these since the computer knows them and resolves all combat accordingly. The computer also keeps a running score to let you know which side is winning. The eight-page instruction book can be read, but it is more fun to put the game into automatic mode and watch the computer take over the playing of both the Allies and the Germans.

For two hours you can sit in front of the screen and watch the raging tides of war as the computer plays itself. You can pick up most of the rules of the game just by watching. The next step is to ask the computer to play the part of the Germans as you assume command of the Allies. You can choose between two levels of difficulty which govern the strategy used by the computer, and you can choose whether or not your forces are invisible (a la Stratego). I made the mistake of going into invisible mode and promptly lost track of all my troops. (The game comes with two plastic boards and pens for keeping track of invisible units.) After honing my skills on the computer I invited one of my friends over for a session and let him be the Allies while I took control of the German army.

Each game lasts about three hours, but allows plenty of opportunities for saving the game so you can continue at a later date. There is a real time element which allows you only a certain amount of time to decide where to move before the computer passes on to the next phase. The element of chance is provided not only in random terrain setup and combat resolution, but also in a comical fashion called panic moves: sometimes the computer

---

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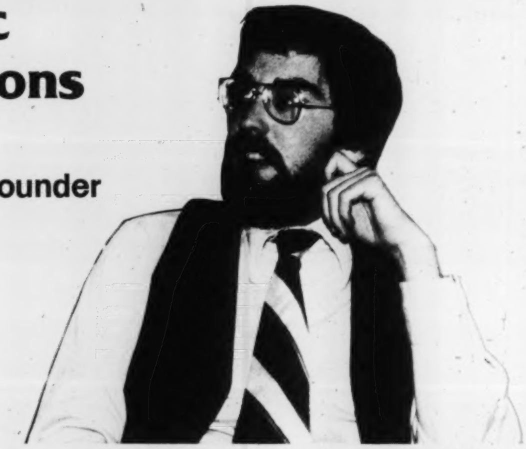
CIRCLE 244 ON READER SERVICE CARD

Sweet Success at Strategic Simulations

We interview founder and president Joel Billings

David H. Ahl



Joel Billings

D.A.: You have an impressive line of war games. Where are you going from here?

J.B.: The current games we have under development are a high-resolution strategy baseball game that we hope to be out before the All-Star game. Another is the Napoleonics game, "The Campaigns of Napoleon."

D.A.: Why a new Napoleonics game?

J.B.: The main difference is that we are trying to put people into the position of the actual leader. In most war games you're not only Commander-in-Chief, but also Division Commander, Batallion Commander, etc. You move every unit to exactly the point where you want them. In Napoleonics, you are just the Army Commander. You give orders to the different units and let the computer move them as if the computer were the Corps Commander or the Division Commander.

D.A.: So that means you give orders to other commanders who may have their own thoughts?

Strategic Simulations' booth at the 6th West Coast Computer Faire.

J.B.: Yes, you have dispatches that you have to send out to the corps. If they are far away from you, there's a time delay. You also may have a corps commander who does what he wants instead of listening to you. Perhaps you say, "you must attack that town. It is priority level one. Take that town." But maybe he's a very unagressive guy. Say there are 100 infantry men in the town, but his timid forward observer reports, "there are 10,000 enemy in that town." He thinks, "we are only 10,000 ourselves, I'm not going to attack that town." He sends a dispatch to you that you get days later saying, "I encountered 10,000 men in this town." In fact, all you encountered was 100 men and the unintelligence and unagressiveness of that leader. In this game, you must now deal with leaders that are going to act on their own, as opposed to being in complete control as in other war games. This game is different.

D.A.: I understand you were pleasantly surprised at the reception that the market gave to *Warp Factor*.

J.B.: Yes, it has done really well and, more than likely because of it, we will be coming out with a campaign game that hooks into that same theme. In other words a campaign space game that has a some economics in it. The player would go around trading on planets but when he gets into a battle he would use Warp Factor to fight.

D.A.: Is *Warp Factor* essentially a war game set in space?

J.B.: It is a tactical level game where you have individual ships (you can have up to 10 ships total—five on a side). At the start all you say, "I want three Enterprise-type ships and two X-wing fighters and I am going to fight some Cloragons. You set up the battle and go at it. It is ship-to-ship. Whoever kills the most wins.

D.A.: But it's not an active game where you have to get the other guy in your sights. It's all strategy?

J.B.: That's right. Before each battle you enter your orders; allocate your energy, different weapons systems, ships, transporters, etc.; and the other player does it also. Then you have the execution phase and the computer prints out what ships have fired at each other, what kind of damage has been done, etc.

D.A.: Is the other player a computer or person?

J.B.: Either. In our games we have both two player and solitaire capabilities. We will continue to do that as much as possible. As you know, most other computer war games are only solitaire. We like the two-player option. That way it has to be strategy oriented. If you design it for two people and then put in solitaire mode I think you get a better game than if you design it just to be a solitaire game. You tend to simplify a lot of things that way.

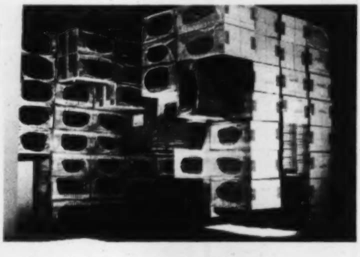
D.A.: Some people have speculated that in the future games will be played on time-share systems or multiple player games will be played on multiple computers.

J.B.: We hope that will happen to some degree. But I don't think it will for quite some time. It is something we would like to work on. But it depends on how many computers are out there and how many people can get different bunches of computers together.

What we would like to do is a fantasy game that has multi-characters like the Dungeons and Dragons game, i.e., when you go into the Dungeon, you go in with several characters, not one man. Furthermore, these characters can be played by many people or by just one person. Each of the characters can do different things. Just like D & D.

D.A.: Except that D & D requires a Dungeon Master.

J.B.: We could have the computer do that.



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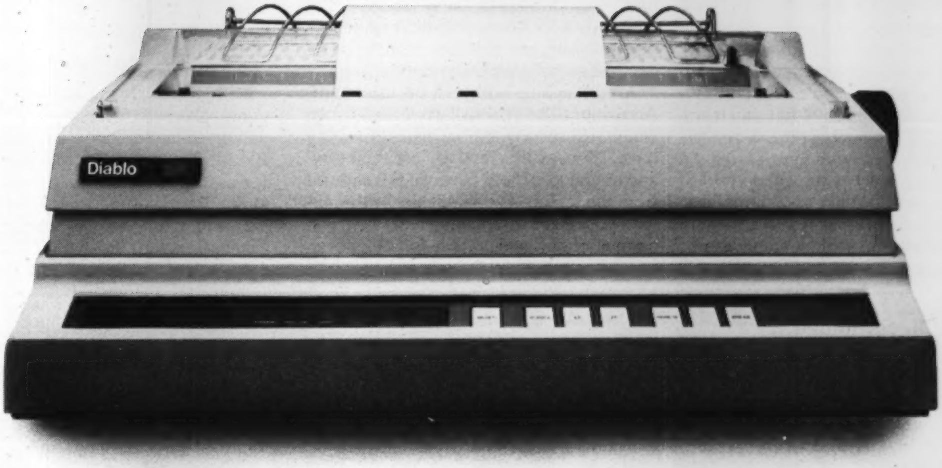

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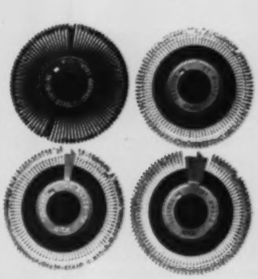

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CIRCLE 268 ON READER SERVICE CARD

Sweet Success, continued...

D.A.: Then there is *Sorcerer's Cave*, which doesn't require a Dungeon Master. It's played with large cards. On each turn a new card is turned over which shows whatever you will go into. It might be just a path to another place, or it could be a chamber. If it's a chamber then there is one thing in each chamber on the first level (the thing could be a treasure, a monster, disaster etc.). On the second level down there are two things in each chamber and on the third level, three. Each player has a party of two to four people and, depending upon the attributes of the people in your party, you select a person to deal with whatever you meet in the chambers. If you meet a disaster and someone has a heart attack, you must select one of the people in your party to carry the victim. If you meet the Sorcerer, you want somebody in your party who has magical powers to deal with him. Drawfs know escape routes and can get around some of the obstacles. Of course, there is always the option of fighting with those you encounter. Or you can try to negotiate and get it to join your party.

J.B.: I don't know what we will do in the fantasy realm. We don't like to copy existing games.

Right now we are doing a game about the Graf Spee. It is about a ship, in World War II, which was sunk off the coast of South America. The game will use the Bismarck system but with more tactical combat.

We plan to do a fantasy game in which the player has several characters.

We are also working on an old-fashioned sailing ship game where you have one ship on each side in semi-real-time (faster than real-time, for in those days a battle could go on for hours). It will be a strategy oriented game but, to some extent, a paddle game. You will give orders, and if you say "Turn," the ship will turn on the board. At the bottom you will have little men which will show you how many crew you have. You will have five "crew-factors" and as you lose them they will be removed from the screen. The same thing will occur with your rigging; you may have a certain amount of sails and, as they are shot down, you lose them from the screen.

D.A.: I understand you only have two game designer/programmers in house. How many people do you deal with on the outside?

J.B.: Right now, four and we are looking at three others.

D.A.: When we were talking earlier, you mentioned that more future releases would be in assembly language.

J.B.: Right. Hopefully most of them and certainly anything that takes a lot of time will be in assembly language. On the other hand, we really can't afford to spend more than six months designing a game. So there's a give and take. The longer we take, the better the game will be, but the longer we take, the less likely we will be successful and ahead of our competition.

D.A.: You also mentioned a strategy of taking a general game framework and overlaying several different scenarios in it, say a space game, or historical game etc.

J.B.:Right. For example, the Graf Spee game planned for release this summer will use many of the same features of the Bismarck system and hopefully be easier for us to program.

D.A.: Fascinating.

For more information, contact Strategic Simulations Inc., 465 Fairchild Drive, Suite 108, Mountain View, CA 94043. ☐

World War II, continued...

will decide that one of your units has panicked and madly moves the unit randomly about, often mucking up your carefully figured plans.

The packaging of Operation Apocalypse is superb. Inside an attractive box are found the rules, a game selection card, a floppy disk, two plastic record charts outlining the 7 x 18 hexagonal battlefield grid, and four color pens for marking your hidden troops. The materials are of high quality. The instructions are beautifully typeset. (IBM are you listening?) Stategic Simulations, Inc. has their act together. They know how to write computer software which has no bugs (I haven't come across any after many hours of play), and they have an extremely user-friendly presentation. (Just put the disk in, turn your machine on, and away you go.) All this for $59.95.

The business software products sold for large mainframe computers look shoddy by comparison and often sell for hundreds of thousands of dollars. Has no one else noticed this disparity?

I shall describe in detail just one of the four games that come with Operation Apocalypse: Advance to Contact. As mentioned before, even though there are elaborate rules in the game, the computer knows them and will tell you when you make an illegal move and describe your possible correct moves.

The main difference in the four games is the objective or victory conditions. The objective in Advance to Contact is to take control of, and hold the cities. The hex grid painted in color on the screen represents a valley which has become a key point in the Allied advance. Units are dispatched to take the towns and hold them before the German player can organize and set up defensive positions that would hold back the advance.

The Germans see what is happening and quickly dispatch units to the area. The Allied units enter from the left side of the screen and the German units enter from the right side. There is a river which crosses the valley. There are open plains, cites, forests and rough terrain in the valley which have varying effects on the movement of troops and the combat of forces. Each side receives 15 units in turns 1-10. The game lasts 20 turns.

There are four types of units in this scenario: tanks, infantry, artillery and engineering units. Each type of unit has different characteristics. The tank battalion, for example, can be set to any one of six modes: defense, normal, transport, fire, attack, and reorganization. The tank battalion cannot move in defense mode, but can resist strong attacks from the enemy (good for holding cities once captured). The transporation mode allows the battalion to move long distances but leaves it vulnerable to attack. The fire mode allows the tank to fire a short distance over rivers or lend support to its own troops from behind the lines. The attack mode allows only limited movement, but quickly destroys an enemy not in attack or defense mode. The reorganization mode allows no movement and is very vulnerable, but permits a unit to build up strength.

A player may selectively change the mode of each of his units at the beginning of each turn. You may either change from any mode to normal mode or from normal mode to any other mode (i.e. to go from attack mode to defense mode takes two turns: attack-normal-defense). The engineering units have an interesting mode which allows them to build a bridge across a river.

Playing The Game

The computer first randomly constructs the hex grid containing the layout of the valley. The Commander of the Allied forces goes first and must follow the following sequence of play:

1. Artillery Arrival Phase. There is some artillery off the screen which can be directed to certain parts of the valley. The player's turn starts with an artillery bombardment. There is nothing to do here except watch various cells of the grid flash as they are hit and listen to the awful sound of explosions.

2. Artillery Plotting Phase. Here is where the player can make a strategic decision. By directing the cursor to various cells of

World War II, continued...

the grid, he can indicate where the next round of artillery will hit on the next turn. You must be careful to remember where you aimed since you may wind up bombarding your own troops next turn.

3. On-Board Artillery Phase. Any tank or artillery battalion you have on the screen which is in Fire mode can be fired. You must be quick and indicate exactly where the fire is directed or the computer will just move on to the next phase.

4. Reorganization Phase. All units in the reorganization mode will take on more strength. This phase is automatic and the players don't see anything on the screen.

5. Mode Change Phase. The player gets the opportunity to change the mode of all units under his command except artillery units which fired in the previous artillery fire phase.

6. Landing Phase. Paratroop units that are scheduled to arrive in this turn land at predetermined drop zones. Seaborne units will land. Units arrive in attack mode except artillery units which arrive in normal mode. The Advance to Contact scenario has no paratroopers or seaborne units so this phase is not used.

7. Movement Phase. This is the most important phase—the one where a player can move any unit which is in a mode which permits movement. When a unit moves into a cell adjacent to an enemy unit then combat automatically takes place (the exception to this is the night moves which take place every fifth turn). The combat between rival forces is resolved by the computer which determines the losses to each side. The strength of each unit is reduced by the appropriate amount. If the strength of a unit drops below 1 then the unit disappears forever from the game and the victor can advance into the emptied cell and continue his attack (if he is in the attack mode). To move a unit, the player types in a number from one to six indicating which one of the six cells around his hex he wishes to occupy. The unit then moves in that direction (if he is not blocked). You get to see, pictured on the screen, the tank or infantry man trudge into the adjacent hex accompanied by a ticking sound not unlike the syncopated rhythm of marching feet. When two opposing forces meet, the combat is represented by a flashing light and an explosive sound.

At the end of each turn the computer displays the score, indicating which side is winning.

Suggestions for Improvement

I guess it is only human nature to want better after being shown the best. After whetting my appetite for computer simulations, Operation Apocalypse has inspired me to imagine ways to improve the game. Although the computer has reduced a game from days to hours of playing time, I still felt a need for more action. The movement of units was too slow (about ten seconds) for my trigger happy fingers. The invisibility aspect was poorly addressed, and offering cards for you to use in keeping track of your men eliminates the advantages of having the computer do the tedium for you. Stratego is nice in that your men remain visible to you, but invisible to your opponent. This is impossible on the screen. Furthermore, the turns take a long time, leaving you and your opponent alternately bored. How about a simulation which incorporates two microcomputers with each player having his own screen showing him only his own men and allowing the players simultaneous moves?

Operation Apocalypse represents hundreds of hours of playing pleasure, a most worthwhile investment. The rules are clearly and briefly explained. The various scenarios and random terrains provide endless tests of one's military prowess. I foresee these computer games stepping closer and closer to reality, and try not to think that they may be training the generals of future wars who might do battle on screens much like the ones described above. ☐

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NEW!

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By David Feitelberg

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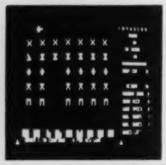

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By Carl Miller

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By William Godwin & Don Knowlton

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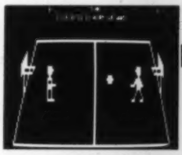

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By John Allen

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CIRCLE 101 ON READER SERVICE CARD

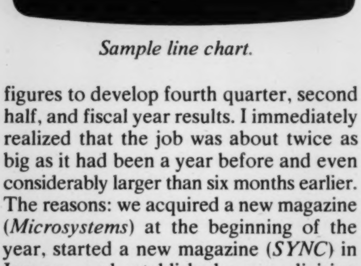
Making sense out of masses of data

Evaluation of VisiTrend and VisiPlot from Personal Software

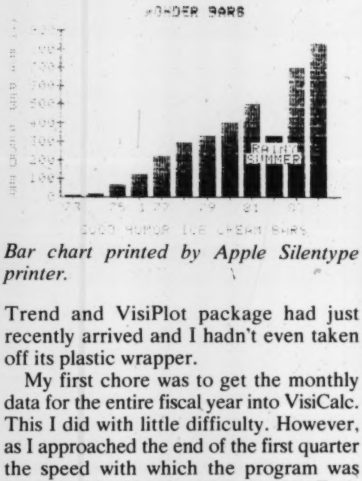
David H. Ahl

July 3, 1981. My financial officer handed me the results for the month of June. Not a remarkable event in itself, except that June 30 marks the end of our fiscal year.

Sitting at my desk, I got out my pocket calculator and started to manipulate the figures to develop fourth quarter, second half, and fiscal year results. I immediately realized that the job was about twice as big as it had been a year before and even considerably larger than six months earlier. The reasons: we acquired a new magazine (*Microsystems*) at the beginning of the year, started a new magazine (*SYNC*) in January, and established a new division (Education Center) in February. All this meant that I was faced with the financial figures from seven separate operating entities rather than the four that we had at the end of the previous fiscal year.



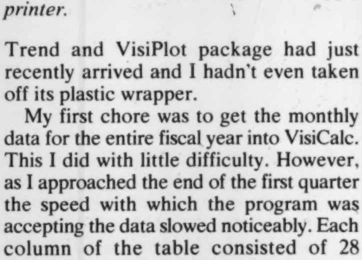
Sample line chart.



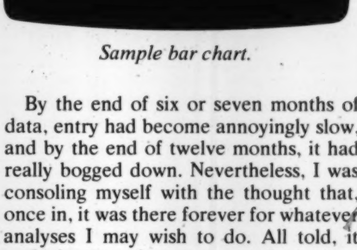
Bar chart printed by Apple Silentype printer.

Hence I decided that it was time to learn VisiCalc, VisiPlot, and VisiTrend. Although I had a minimal working knowledge of VisiCalc, the combination VisiTrend and VisiPlot package had just recently arrived and I hadn't even taken off its plastic wrapper.

My first chore was to get the monthly data for the entire fiscal year into VisiCalc. This I did with little difficulty. However, as I approached the end of the first quarter the speed with which the program was accepting the data slowed noticeably. Each column of the table consisted of 28 individual entries such as total sales, subscription revenue, retail sales, Peripherals Plus individual sales, and the like. In addition, each column had eight calculated subtotals and eight calculated percentages. Thus, at the end of a quarter the program was dealing with approximately 40 x 3 = 120 separate pieces of data.



Sample area chart.



Sample bar chart.

By the end of six or seven months of data, entry had become annoyingly slow, and by the end of twelve months, it had really bogged down. Nevertheless, I was consoling myself with the thought that, once in, it was there forever for whatever analyses I may wish to do. All told, it took about two hours to enter the approximately 275 data points for a full fiscal year. I had also, in that time, entered all of the column and row titles and the various formulas for calculations of subtotals and percentages, and had printed out the resultant table.

A brief aside. Printing is probably one of the least capable attributes of VisiCalc. There is no "intelligence" whatsoever built into the print routines. For example, the

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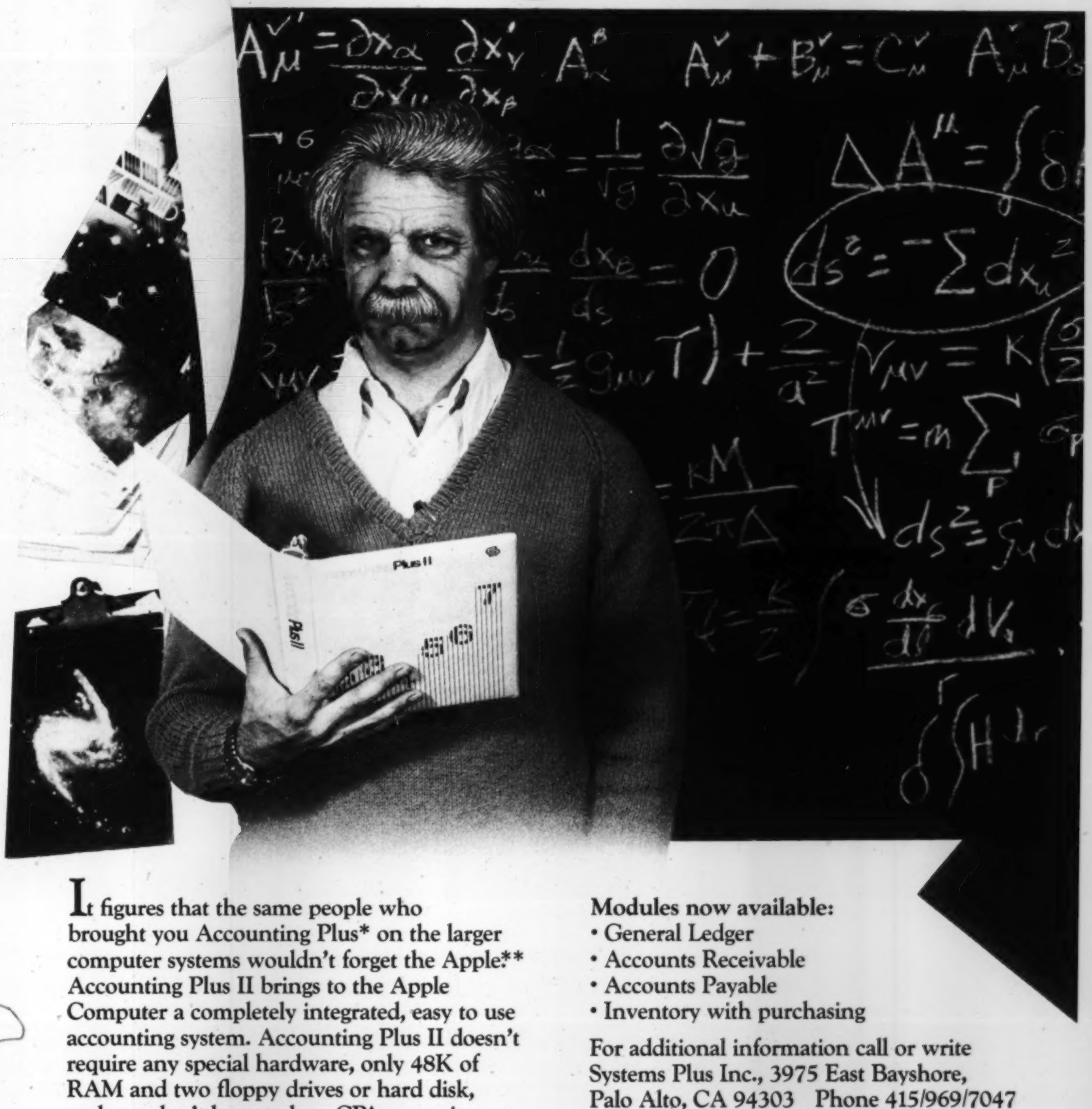
It Figures



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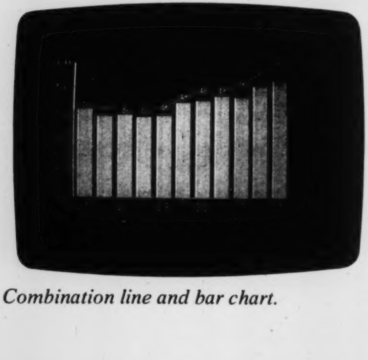
printer will space across by individual spaces to "print out" a blank line. Furthermore, the routines do not take advantage of printers that do have some "intelligence" built in. I use a Diablo 1640 printer with bi-directional printing and a fairly large print buffer built in. While not as fast as a line printer, for normal correspondence the printer is more than adequate. On the other hand, VisiCalc does not take advantage of the buffer or bi-directional printing capabilities and, appears to wait for a signal from the printer that it has printed a character before sending the next one. Thus, a 60-line page that is normally printed out in about two minutes, takes over ten minutes with VisiCalc.

I don't mean to sound negative. The program is still faster, more capable, and more accurate than any alternative, particularly pocket calculator and pencil. Nevertheless, there are certain frustrations in using it.

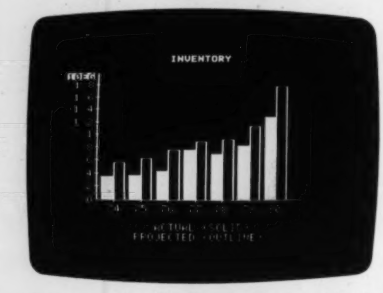
VisiPlot

Currently available for only the Apple computer, VisiPlot is one-half of a new package from Personal Software that also includes VisiTrend. The VisiPlot portion of the package, as its name suggests, allows one to display data in graphical form on the screen and print it out on a wide variety of supported line printers. The program can make six types of charts: line, bar, area, pie, hi-lo, and scatter. In addition, it allows combining the same or different types of charts. For example, a line chart may contain one, two or three lines. A comparative bar chart may display two different bars on the same X axis or two bar charts may be displayed one above the other. A line chart may be combined with a hi-lo chart. While the possibilities are not endless, they should be sufficient to meet most normal business needs.

Like VisiCalc, the VisiTrend and VisiPlot package is entirely menu-driven. Actually, VisiTrend and VisiPlot make much more extensive use of menu commands than does VisiCalc. Menu items are selected with the right and left arrow keys and space bar. Although the commands do what one would "naturally" expect, to provide even more help, when a one-word menu item is selected, it is highlighted in reverse video, and a more complete explanation of the item appears immediately above it. Even if one presses the wrong key, or selects an inappropriate item, there are built-in escapes and exits on every level at nearly every point. Usually, when using a program for the first time, I get into some kind of trouble that necessitates reloading the entire disk. In my first eight hours with VisiTrend and VisiPlot, this did not happen once. I am not saying that all went perfectly; however, when faced with a difficult situation, I was always able to bail out without losing any data and without having to reload the program.



Combination line and bar chart.



Bars may be displayed side by side for comparative purposes.

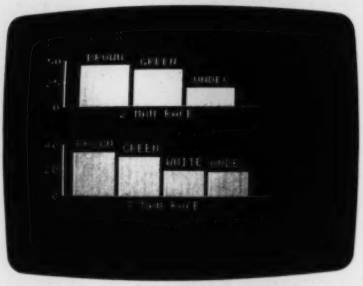
As the manual says, "Any time you seem to be at a dead end with no way to continue, press any key except reset, shift, or control." From my personal experience, I can verify that this advice really works.

A Tutorial Manual

The manual is divided into three sections. The first section (24 pages) is an introduction to VisiTrend and VisiPlot including definitions, program and disk loading instruction, and some general background about using the menu. The majority of the manual, 105 pages in all, is devoted to a tutorial in how to use VisiPlot, VisiTrend, and the data entry and edit program. This tutorial section is divided into five lessons, each of which takes about one hour to go through fairly thoroughly.

After completing two lessons in their entirety, I skipped around a bit to get to the sections describing what I really wanted to do with the data that I had. As a result, I probably missed learning about some of the features and nuances of the system. On the other hand, in a six-hour period, I was able to produce sixteen charts and run several trend projections, which was far more productive than the same six hours would have been with calculator, pencil, and graph paper.

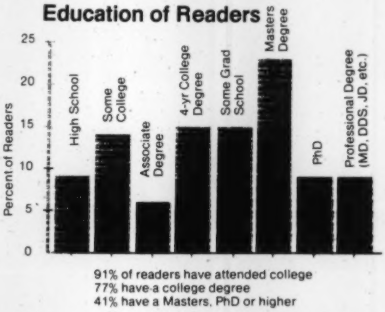
The third section of the manual, 38 pages, is a reference guide to the use of VisiTrend and VisiPlot. I saw nothing in it that was not previously covered in the tutorial section. However, it may be more efficient once one is proficient with the system, to look up desired capabilities in the reference section, rather than leafing around in the tutorial section.



Two groups of bars may be displayed simultaneously.

Personal Software also thoughtfully includes a pocket reference card which has no less than fourteen 3 x 6" panels of information. One wonders whether pocket reference cards aren't getting a bit out of hand; but I found this one quite useful.

As the saying goes, "A picture is worth a thousand words," hence I have included a substantial number of charts with this article. Some of them are taken directly from the screen while others are printed on an Apple Silentype printer. There is little difference between the two as the print out program merely replicates the high resolution screen on the Silentype printer. Other printers that are supported by the VisiTrend/VisiPlot program include the IDS Paper Tiger 440 and 445 (with graphics option installed), the NEC Spinwriter 5510, 5515, 5520, and 5525 (with graphic option installed) and the Trendcom 200.



Charts may be "improved" by adding normal type.

Data Entry Surprises

The VisiTrend/VisiPlot package contains an extensive data entry and editing facility. This facility allows the user to create a new data series, and modify existing data series. The editor allows one to jump to specific places within a list, insert new data points between existing data points, delete points, format the manner in which data are displayed, print the contents of a series and the like. Like

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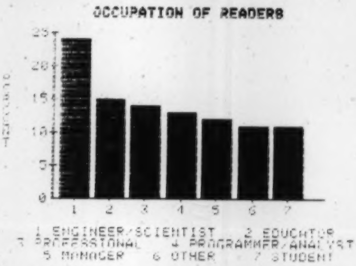
VisiTrend, continued...

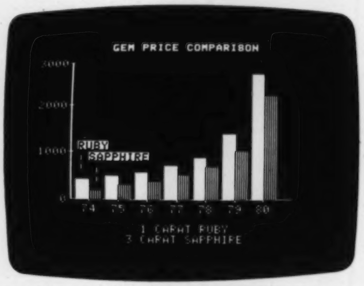


Bar chart printed by Apple Silentype printer.

the menu-driven plotting portion of the program, the data entry and editing portion of the program were simple to use.

However, I did not expect to have to use them with live data as I had all of the data that I wanted entered on a VisiCalc disk. VisiTrend/VisiPlot has the ability to accept data from VisiCalc which has been stored in the "standard" data interchange format (DIF). However, as a sentence buried in the middle of page 2-49 points out, "This means that interchange between the two products is only possible if you have a copy of the VisiCalc program at a version number higher than the 1.37." While I do, it just so happens it was not the one that I used in entering all the fiscal year data.

Even so, it appears that it would have taken at least as much time to edit the VisiCalc data for plotting as it did to enter new data. For example, my columns consist of three individual months followed by a quarterly summary. For plotting purposes, each of the quarterly data points would have to be edited out. Likewise, my rows include individual sales results followed by subtotals and percents for each of our seven divisions. Again the subtotals and percents would have to be deleted. I judge that re-entering the data points that I wished to plot took no more time than editing the original VisiCalc file. This, of course, would not always be true and the data interchange feature is not one to be downgraded.



Labels may be inserted anyplace on the chart.

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As an example of what T/Maker II can do, see the chart below. The operator entered only the data shown in boldface. T/Maker II calculated and reported all the other values.

		— Actual —		Growth		Total		—Projected—	
	1978	1979	1980	Rate	Average	(000's)	1981	1982 *	1985
Item A	**42,323**	**51,891**	**65,123**	24.04	53,112	159.34	80,782	100,206	191,262
Item B	**45,671**	**46,128**	**49,088**	3.67	46,962	140.89	50,891	52,761	58,791
Total	87,994	98,019	114,211	13.93	100,075	300.22	131,673	152,966	250,053
% Item	48.10	52.94	57.02	8.88	52.69	158.1	61.35	65.51	76.49
% Item	51.90	47.06	42.98	-9.00	47.31	141.9	38.65	34.49	23.51
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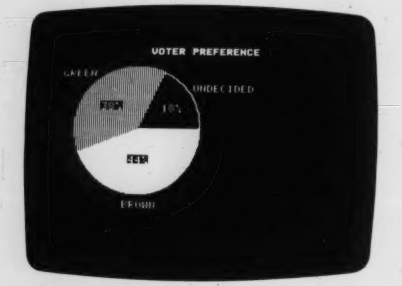
VisiTrend, continued...

As mentioned earlier, nearly every combination of charts is possible. Unfortunately, I tried to produce several that, try as I might, I could not. For example, using the VisiTrend program (more about that later) I ran a projection of sales for the next twelve months. I attempted to plot current sales for periods one to twelve and future sales for periods thirteen to twenty-four. Unfortunately, without extensive editing, this is not possible. It was easy enough to plot both sets of data on a line chart however it was not easy to plot data set one from period one to twelve and data set two from thirteen to twenty-four. Also, since most of my other charts were bar charts, I wished to present these data (twenty-four months worth) in a bar chart format. Unfortunately, I could not do it. Some experimentation indicated that the upper boundary on the number of bars that could be displayed is sixteen, however, I could not find this any place in the manual.



Sample pie chart.

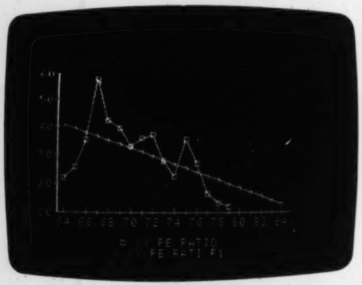
Another minor difficulty I ran into was in the printing out of pie charts. Again, not in the manual, is the fact that a pie chart can only have eight slices and, unfortunately, I was trying to produce a ten-slice pie. Much consternation and gnashing of teeth until I figured out what was amiss and combined several of the pieces. Another small problem with pie charts: the eight different colors looked delightful on the screen, however, on the printer several of them are represented by the same method of shading. Hence, I found it was most satisfactory to use just three colors: white, black and green which, on the printer, are all distinctly different.

VisiTrend

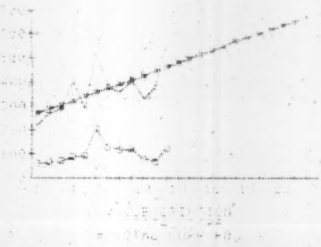
The VisiTrend program develops ancillary data series used in analyses and forecasting techniques. The methods include derivation of moving averages, smoothing data, percent of change, leading, lagging and cumulative total functions. Additionally, new series can be created by taking ratios logs, or other mathematical or logical transformations of the data. The program performs linear multiple regressions (using the ordinary least squares method). It also calculates and displays the major statistical measures of a multiple regression including the standard errors of the coefficients and the regression, t-statistic, R-bar squared, the F-statistic and the Durbin-Watson statistic. It also performs trend line forecasting.

Needless to say, this is an extremely comprehensive statistical package and most users will not need a fraction of what the program can deliver. Nevertheless, there are probably one or more statistical measures useful to each different user, so the program offers a complete smorgasbord.

For my purposes, I was interested in trend forecasting using linear regression and a moving average function with exponential smoothing. I had no trouble using either of these capabilities and, in about one-half hour, was able to develop several trend forecasts and moving averages. I then stored the results of these forecasts, moved back to the VisiPlot portion of the package, and plotted the results.



Line chart with a projection made by VisiTrend.



Two lines on chart with VisiTrend least squares projection.

While it is helpful to have detailed statistics, one can get overwhelmed. At one point, when I was running trend lines on virtually everything in sight, I took a break and got to thinking, "What am I going to do with all of these data?" The computer, of course, will generate anything you want. However, it is only a tool and human judgment must be used, probably more than ever before, to determine what the computer ought to be doing.

In Summary

I found the VisiTrend/VisiPlot package exceptionally user-friendly and easy to learn. The manual, particularly the tutorial section, is outstanding. While user mistakes are inevitable, the software is quite forgiving and rarely, if ever, loses any data. The package helps analyze data accurately, produces attractive charts and graphs, saves time, and is an outstanding business tool. I recommend it highly.

VisiTrend/VisiCalc is produced by Personal Software, Inc., 1330 Bordeaux Dr., Sunnyvale CA, 94086 and is available for $259.95 at computer stores throughout the country. ☐

Other New Visi-Packages

VisiDex, named for the popular Rolodex information retrieval system, allows storage and retrieval of screens full of information in a free-form, unstructured manner. It can also maintain a calendar of appointments and reminders. One can think of the screen as a 5 x 7" filing card with up to twenty lines. Up to thirty-six keywords can be specified for each screen and the entire screen can be recalled by any keyword. Additional facilities include the ability to set up "templates" for applications such as mailing lists, on-screen editing, sorting keywords in alphabetical or numeric order or for print out purposes, and selective printing of partial screens. The price of VisiDex is $199.95.

VisiTerm is a communications software package designed for use with several popular modems such as the DC Hayes Micro Modem and others. The package provides full upper and lower case ASCII communications, with proportional spacing and smooth scrolling at speeds up to 1200 bps. The package is principally designed for the transmission of VisiCalc data, text, VisiPlot graphics, and related programs. The program comes with pre-defined regular, boldface, and APL characters, although it also allows the user to design his own character set. Like the other packages in the series, VisiTerm is menu driven with single stroke characters. Retail price is $149.95.

As mentioned in the VisiPlot review, VisiCalc has been updated to support a Data Interchange Format (DIF), a program independent data storage technique. The updated VisiCalc also supports Boolean functions and arithmetic comparisons as well as having 17 new simplified commands. It, like the other new Visi-series packages, is supplied on the Apple 16-sector diskette format. Price of the revised VisiCalc is $199.95. ☐

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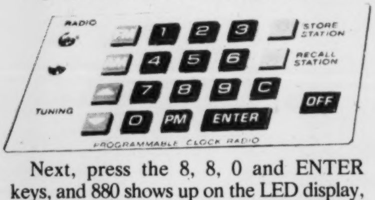
CIRCLE 324 ON READER SERVICE CARD

GE Programmable Clock Radio

THE GREAT AWAKENING

Stephen B. Gray

Set the DISPLAY switch to RADIO, then press calculator-like keys 9, 6, 3 and ENTER. The 5/8"-high digital LED display shows 96.3, the LED near the FM key lights up to show you've selected an FM station and, if you're in New York City, WQXR-FM comes in loud and clear.



Next, press the 8, 8, 0 and ENTER keys, and 880 shows up on the LED display, the LED near the AM key lights up, and in New York you're listening to WCBS-AM.

Computer Control

How does this little $116.95 table-top radio—which has no tuning dial—tell the difference between FM and AM stations? That's only one of the many things this General Electric 7-4880 programmable digital clock radio can do, because it's built around a Texas Instruments TMS1100 four-bit, single-chip microprocessor.

The 1100 is a member of TI's TMS1000 family, and has 2,048 bytes of ROM, 512 bits of RAM memory. Over 40 million of the low-cost TMS1000-family chips have been shipped in the five years they've been used in industrial controllers, computer terminals and peripherals, timers, TV tuners, appliances, toys, games, etc.

Presets and Scan

While you're listening to WQXR, press the STORE STATION key and then the 1 key. Later, anytime you want to hear WQXR, just press the RECALL STATION and 1 keys, and you've got it. You can preset six of your favorite stations this way, with any mix of FM and AM stations you want.

Using the up-arrow and down-arrow keys, you can scan across either the FM or AM bank, if you're "just shopping." Press the FM key, and the display reads 88.1. Press the up-arrow key, and the microprocessor changes the display to 88.3, because it's been programmed to display only the frequencies at which you'll find FM stations, which are 0.2 megahertz apart.

Keep the up-arrow key held down, and the FM band will be swept all the way from 88.1 to 107.9 MHz in about 22 seconds, or the AM band from 530 to 1610 KHz in about the same time, going from 530 to 540 to 550 to 560, etc. On either band, when you reach either end, the scan stops. Just press the up-arrow or down-arrow key again, and the scan starts all over again, moving immediately from 107.9 to 88.1 or vice versa, or from 1610 to 530 or vice versa, so you don't ever have to backtrack.

If you accidently enter a frequency not allowed for a station, such as 555 AM or 99.2 FM, the display will alternate between an E for error and the number you've entered. You can't fool the microprocessor; it knows what frequencies are allowed.

Press the OFF key, and the display read OFF. Then press the AM or FM key, and the radio automatically tunes to the last AM or FM station played, thanks to the microprocessor's memory.

Time Display

That's only the radio portion of this clock radio, which General Electric calls "The Great Awakening," and which is advertised as "The GE Computer Radio. At 6:00 A.M. it's smarter than you are." The same LED display that shows you the station frequency, will also display the time.

To set the time, just set the DISPLAY switch to TIME, press the keys for the time, plus the PM key if necessary, and ENTER. If you try to enter the time as 12:60, the computer will reject it, and display an E.

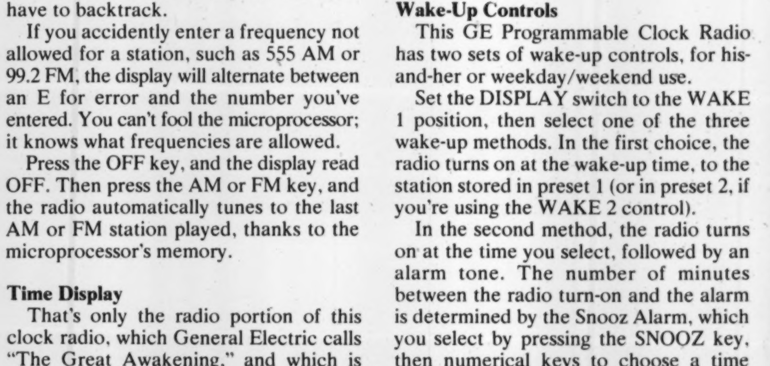
By the way, if you turn off the room lights, the time/frequency display immediately switches from bright to dim. This is not the microprocessor's doing, but a photocell that automatically adjusts the display to "optimum brightness in any room," as the manual puts it.

Wake-Up Controls

This GE Programmable Clock Radio has two sets of wake-up controls, for his-and-her or weekday/weekend use.

Set the DISPLAY switch to the WAKE 1 position, then select one of the three wake-up methods. In the first choice, the radio turns on at the wake-up time, to the station stored in preset 1 (or in preset 2, if you're using the WAKE 2 control).

In the second method, the radio turns on at the time you select, followed by an alarm tone. The number of minutes between the radio turn-on and the alarm is determined by the Snooz Alarm, which you select by pressing the SNOOZ key, then numerical keys to choose a time between 1 and 59 minutes, then ENTER. The SNOOZ cycle is preset in the micro-



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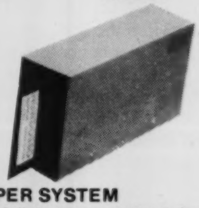

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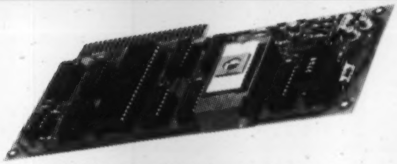

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CIRCLE 118 ON READER SERVICE CARD

processor to nine minutes at the factory, but can be changed.

The third wake-up method sounds only the alarm tone, without turning on the radio. The loudness of the alarm tone can be adjusted with the volume control.

If both WAKE 1 and WAKE 2 are set to the same wake-up time, the microprocessor forces WAKE 1 to override, and the radio will tune in to the station stored in preset 1.

You can drift off to sleep with the radio playing, and it will turn itself off automatically. Just switch the DISPLAY selector to the SLEEP position, choose the number of minutes the radio is to play before turning off, by entering it on the keyboard, and press ENTER. To turn the radio off sooner, just press OFF.

So you can set this radio to lull you to sleep on one station, turn itself off, then wake you with music from another station and/or the alarm tone.

Block Diagram

The 7-4480 is the first General Electric radio product to use a microprocessor. The internal circuitry consists of four major electrical blocks: frequency-synthesized tuner, timekeeping function, user controls, and power supply. The block diagram is something like that shown in Figure 1.

The synthesizer in this GE radio uses varactor diodes in place of the conventional metal-plate variable-capacitor gang tuner. When operated with reverse bias, these diodes effectively look like capacitors, whose capacity can be varied by changing the magnitude of the applied DC voltage.

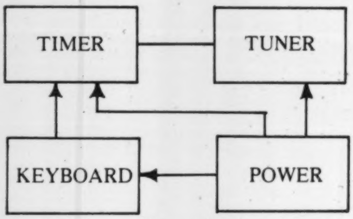

Figure 1.

Tuning thus involves varying a DC voltage instead of physically moving the plates of a conventional gang tuner.

Overall, the varactor system is more complicated and more expensive than the conventional gang tuner. However, because it is electrically tunable, it is compatible with circuits controlled by the microprocessor.

Because the local oscillator uses varactors and is tunable by varying its DC voltage, it is known as a voltage-controlled oscillator (VCO). By building this VCO into a digitally-controlled feedback system, whose parameters are externally controlled, a phase-locked loop (PLL) system is formed.

The PLL is a stable, highly accurate oscillator that can be precisely tuned over a wide frequency range when supplied with a digital input code. By varying this code word appropriately, it is possible to tune in any station on either the FM or AM band.

In the GE system, the PLL code word is generated as follows:

1. The user enters the desired station frequency into the keyboard.
2. The microprocessor reads this keyboard input, then generates the appropriate 15-bit digital code word.
3. The microprocessor sends the code word to the crystal-controlled PLL in serial form, one bit at a time.
4. When the PLL has received the entire code word, it uses this information to tune the radio to the station requested by the user.

The PLL compares two frequencies to see if they're in phase. The PLL has a frequency divider, programmed by the 15-bit code word, which divides the frequency of the station you select, down to a lower frequency that's compared with a crystal-controlled reference frequency. If the divided-down frequency is above or below the reference frequency, a feedback correction is applied to the varactor diodes, to close the loop.

The microprocessor controls radio tuning, and also keeps time by monitoring the 60-Hz power line and counting the cycles. When the time changes, the microprocessor updates the display-driver IC by sending it a 32-bit serial code word.

Power-Failure Protection

The clock radio has built-in power-failure protection. To use it, plug a 9-volt alkaline battery into the battery compartment.

When the AC power fails, the battery will maintain the memory storage and timekeeping operations, for a short period. However, the battery hasn't enough power to permit using the radio as a portable; the battery only keeps the memory on and the clock going.

The 7-4880 will still be around by the time you read this. A very similar model was in the works at the time of this writing, with a blue fluorescent time display, separate alarm indicator, and with a tone control for the radio.

General Electric could easily have added a calculator to the clock radio, even if the display has only four digits. But, according to a GE engineer, "Market research tells us that people aren't interested in that kind of thing, generally. The marketing policy is to go for the common denominator." □

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CIRCLE 195 ON READER SERVICE CARD

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	IBM Compatible (128 B/S, 26 Sectors) w/ W.P.N.	3062	2.04	–	–	–	–	–	–	740-0	–	–	FD34-9000	–	–
	IBM Compatible (128 B/S, 26 Sectors) w/ W.P.N. & Hub Ring	3064	2.39	–	–	–	–	–	–	–	–	–	FD34-9000	–	–
	IBM Compatible (128 B/S, 26 Sectors) REVERSIBLE	1779	3.19	473072	54431	–	–	–	FD-2	740/2-0	–	15150	FF34-9000	F171111X	–
	IBM System 6 Compatible	3066	2.04	473077	54561	800509	1669959	–	–	740-0 086	–	15003	FD60-9000	F161111X	–
	IBM Compatible (256 B/S, 15 Sectors)	3109	1.99	473073	–	800584	2305845	–	–	740-3600	–	15005	FD36-9000	F112111X	–
	IBM Compatible (512 B/S, 8 Sectors)	3110	1.99	473074	–	800585	1669954	–	–	–	–	15004	FD80-9000	F113111X	–
	Shugart Compatible, 32 Hard Sector	3015	1.99	470801	53802	101/1	–	FH1-32	FD-132	740-32	S/A 101	15025	FD32-9000	–	421322
	Wang Compatible, 32 Hard Sector w/Hub Ring	3087	2.49	–	54491	–	–	–	–	740-32RH	–	–	–	F37A411X	–
	CPT 8000 Compatible	3045	2.69	–	–	–	–	–	–	–	–	15220	–	–	–
Flexible Disc 1d Single Headed Drives Double Density Media	IBM Compatible (128 B/S, 26 Sectors)	3090	2.69	474071	54568	3740/1D	–	FD1-128/M2100	FD-1D	741-0	–	–	FD34-8000	F131111X	423002
	Soft Sector (128 B/S, 26 Sectors) REVERSIBLE	3093	3.69	–	–	–	–	–	–	–	–	–	–	–	–
	Shugart Compatible, 32 Hard Sector	3091	2.69	470801	54596	101/1D	–	FH1-32D	–	741-32	S/A 103	15075	FD32-8000	F33A411X	423322
	Wang Compatible, 32 Hard Sector w/Hub Ring	3088	3.09	–	–	–	–	–	–	–	–	–	–	–	–
Flexible Disc 2s Double Headed Drives Single Density Media	Soft Sector (128 B/S, 26 Sectors)	3113	3.09	–	54420	800814	1766870	–	–	–	S/A 150	15153	FD10-4026	F121111X	–
	Soft Sector (256 B/S, 15 Sectors)	3106	3.09	473477	54226	800815	2736700	FD2-256D	–	742-0	–	15154	FD10-4015	F122111X	424612
Flexible Disc 2d Double Headed Drives Double Density Media	Soft Sector (Unformatted)	3102	3.09	473485	–	DY150	–	FD2-XDM	FD-2D	743-0	–	15103	DD34-4001	–	425002
	Soft Sector (128 B/S, 26 Sectors)	3119	3.09	–	–	–	–	–	–	–	S/A 150	–	–	–	–
	Soft Sector (256 B/S, 26 Sectors)	3103	3.09	473471	54325	800817	1766872	FD2-256D	–	743-0/256	–	15101	DD34-4026	F144111X	425602
	Soft Sector (512 B/S, 15 Sectors),	3114	3.09	473472	54479	800818	1669044	–	–	743-0/512	–	15100	DD34-4015	F145111X	425612
	Soft Sector (1024 B/S, 8 Sectors)	3104	3.09	473473	54485	800819	1669045	–	–	743-0/1024	–	15102	DD34-4008	F147111X	425622
	32 Hard Sector	3105	3.09	470851	–	101/2D	–	FH2-32D	–	743-32	S/A 151	15125	DD32-4000	F34A411X	425322
	Burroughs B 80 Compatible, 32 Hard Sector	3092	3.09	–	–	–	–	–	–	–	–	–	–	F34A811X	–
	Soft Sector (1024 B/S, 8 Sectors) w/ Hub Ring	3116	3.49	–	–	–	–	–	–	–	–	–	–	–	–
	Shugart Compatible, 32 Hard Sector	3181	3.39	–	–	–	–	–	–	–	–	–	DD32-4000	–	–
Flexible Disc FD Memorex 651 or Equiv Drive Compatible	FD VI (Vinyl Jacket)	30712003	2.69	470651	–	FDIV	–	–	FD-105	511-0	–	15026	FD86-1000	F61A111X	–
Mini Flexible Disc 1s 5¼" Single Headed Drives Single Density Media	Soft Sector (Unformatted)	3401	1.94	475001	54256	104/1	–	MD1	MD 1	744-0	S/A 104	15300	MD525-01	M11A211X	441002
	10 Hard Sector	3403	1.94	475010	54257	107/1	–	–	MD 110	744-10	S/A 107	15325	MD525-10	M41A211X	441102
	16 Hard Sector	3405	1.94	475016	54258	105/1	–	MH1	MD 116	744-16	S/A 105	15326	MD525-16	M51A211X	441162
	Soft Sector (Unformatted) w/Hub Ring	3431	2.14	–	–	–	–	–	–	–	–	–	MD525-01	–	–
	10 Hard Sector, w/Hub Ring	3433	2.14	–	–	–	–	–	–	–	–	–	MD525-10	–	–
	16 Hard Sector, w/Hub Ring	3435	2.14	–	–	–	–	–	–	–	–	–	MD525-16	–	–
Mini Flexible Disc 1d 5¼" Single Headed Drives Double Density Media	Soft Sector (Unformatted)	3417	2.14	–	54646	104/1D	–	–	–	–	–	–	MD525-01	–	–
	10 Hard Sector	3418	2.14	–	54649	107/1D	–	–	–	–	–	–	MD525-10	–	–
	16 Hard Sector	3419	2.14	–	54652	105/1D	–	–	–	–	–	–	MD525-16	–	–
	Soft Sector (Unformatted) w/Hub Ring	3481	2.34	–	–	–	–	–	–	–	–	–	MD525-01	–	–
	10 Hard Sector w/Hub Ring	3483	2.34	–	–	–	–	–	–	–	–	–	MD525-10	–	–
	16 Hard Sector w/Hub Ring	3485	2.34	–	–	–	–	–	–	–	–	–	MD525-16	–	–
Mini Flexible Disc 2d 5¼" Double Headed Drives Double Density Media	Soft Sector (Unformatted)	3421	2.59	–	54624	104/2D	–	–	–	–	S/A 154	–	MD550-01	–	–
	10 Hard Sector	3423	2.59	–	54627	107/2D	–	–	–	–	S/A 157	–	MD550-10	–	–
	16 Hard Sector	3425	2.59	–	54630	105/2D	–	–	–	–	S/A 155	–	MD550-16	–	–
	Soft Sector (Unformatted) w/Hub Ring	3491	2.79	–	–	–	–	–	–	–	–	–	MD550-01	–	–
	10 Hard Sector w/Hub Ring	3493	2.79	–	–	–	–	–	–	–	–	–	MD550-10	–	–
	16 Hard Sector w/Hub Ring	3495	2.79	–	–	–	–	–	–	–	–	–	MD550-16	–	–

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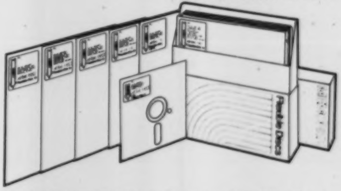

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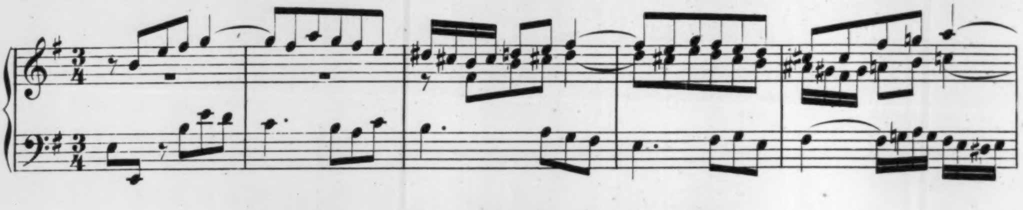


Update on Digital Audio and One Man's Pick in Records

David H. Ahl

Two years ago at the summer Consumer Electronics Show I was intrigued to see how digital electronics were making inroads into audio equipment. I described many of these principals and the resulting products in an extensive article, "Digital Audio" in *Creative Computing*, June 1980.

Carrying this technology one major step forward, at the 1981 Winter CES, JVC showed the first commercial all digital record.

The terminology is confusing. "Digital" records have been with us for several years. However, the digital record pioneered by Telarc and Crystal Clear uses a digital mastering process but the final disk can be played on a standard turntable. Not so for the all digitals. The disk is identical to a video disk and consists of 1's and 0's which in the JVC design are read by a capacitance scan device. Unfortunately show goers on Friday and Saturday did not hear the JVC system as the prototype disk had been ripped off by someone on Thursday. One wonders what he's going to do with it.

A new development in high quality recording, CAX, was announced recently by CBS. The CAX process, also called "companding," is a combination of two processes; namely, compression of dynamic range during initial recording and expansion of dynamic range during playback. The system uses a low cost ($50) decoder added to a conventional hi-fi system. With it, a compressed record provides a dynamic range equal to the best digital record (85 db) but with virtually no surface noise and at a cost per disk equal to conventional records. Companded records and decoders should be available in about six months.

I heard a demo of the system at the ITA conference in March and hearing quiet passages with complete absence of surface noise was absolutely remarkable.

At CES, the equipment manufacturers seek the highest quality source material to show off their amplifiers, speakers, cartridges, etc. This usually means a digital, direct-to-disk or half-speed master record. When I evaluated the various digital audio products, I reasoned that I ought to use the same high quality source material. Hence, I acquired fifteen assorted records. (See record reviews in *Creative Computing*, Mar 79, Aug 79 and Jun 80.

In the spring of 1980, *The New York Times* ran an article describing "small" recording manufcturers. Feeling a kinship to these companies—after all, *Creative Computing* was once a small magazine—I sent for a cross-section of their wares. While the majority of these disks did not have the same sonic quality of the digitals, they almost all were good quality performances. Furthermore, many were not available on any major label.

Most of the small labels focus on an unfulfilled niche in the musical spectrum. Some are dedicated to young, modern composers. Others seek out original versions of old manuscripts. Almost all are committed to performances played on the instruments originally specified by the composer and not a later arranger who adapted the work to modern instruments.

In just the past quarter century and particularly the last decade, recordings of early music, played on period instruments or accurate copies, have become widely available. In the 50's and 60's, groups like the Deller Consort and New York Pro Musica were the exception. Now they abound. What these performers have found and you will find in live performances or recordings—is that the music is almost infinitely adaptable. Older scores give the performers a good deal of freedom with regard to instrumentation. As a result, each performance is virtually assured of having a fresh sound. This is a delight you'll experience when you sample various disks that I've mentioned below plus other records on these labels.

The quality of the pressings are uniformly high. This is a welcome relief in a day where the reject rate on records from major manufacturers is climbing faster than inflation. The manager of a Sam Goody store in the New York area told me that a 20% flaw rate was not uncommon.

In my previous piece, I commented on the difficulty exchanging a flawed record purchased in a distant city. Keith Holzman of Nonesuch wrote to me informing me that they, at least, would accept a defective return directly for a replacement if it could not be exchanged at the retail outlet. This also is the policy of the small record companies I contacted.

Although most of the small companies are striving for widespread retail distribution, they generally do not have it today. Hence, most have catalogs and will accept direct mail orders.

I've listed some disks below that are worthy of your consideration. Since this is a one man review, obviously it reflects my personal taste and knowlege. Although I occasionally listen to rock and disco music, I hardly consider myself an expert on it. Hence, I've restricted these listings to the classical area. Companies with records made by digital, direct-to-disk and other high quality recording techniques are identified by HQ.

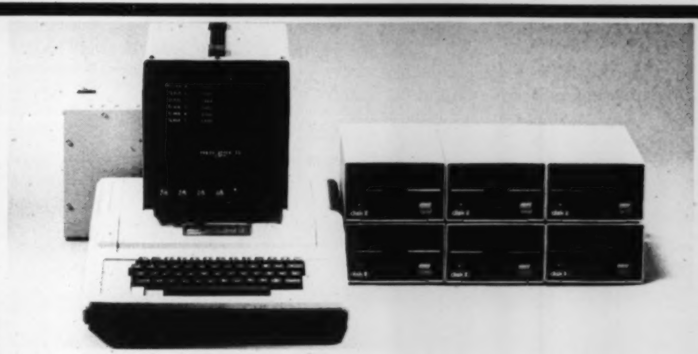
American Gramaphone (HQ)

Fresh Aire III by Mannheim Steamroller. This series of three records is a collection of original music set in a hybrid musical style combining the long-lived forms of the classics, performed on today's instruments in today's idiom. Volume III begins with the fanfare "touch piece" Toccata performed on a synthesized sequencer. The balance is mixed moods in "the style of 18th century rock 'n roll. " Different and tasty.

Chalfont Records (HQ)

Danzas Fantasticas is a disk of classical Spanish dances by Falla, Turina, Albeniz and Granados. Familiar pieces such as Falla's "Ritual Fire Dance" and Albeniz's "Triana" from "Iberia" along with several unfamiliar pieces are played with precision and aplomb by the London Symphony under Morton Gould.

Carlo Curley Goes Digital. The magnificent 4-manual Allen organ with 164 stops and 5500 watts of power driving 380 speakers is played by Carlo Curley, "the



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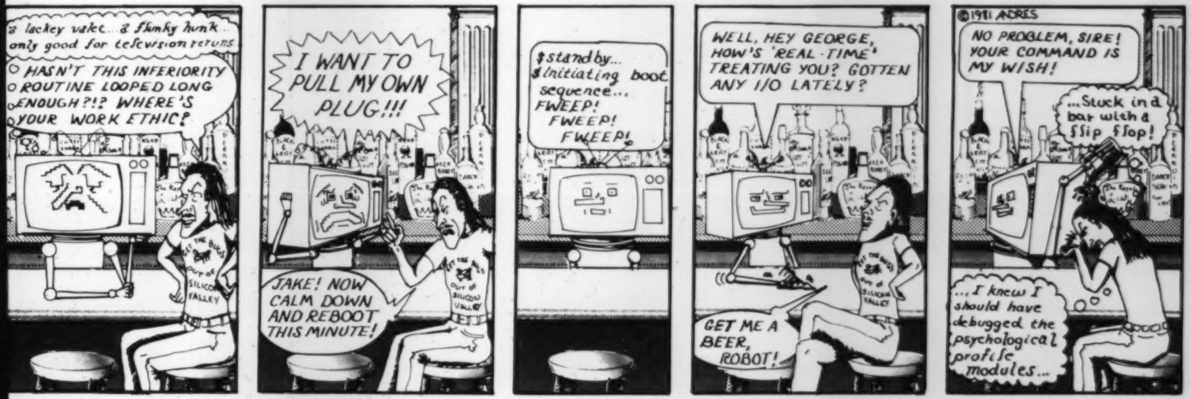
Chas Andres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FWEEP!
FWEEP!
FWEEP!
WELL, HEY GEORGE, HOW'S 'REAL-TIME' TREATING YOU? GOTTEN ANY I/O LATELY?
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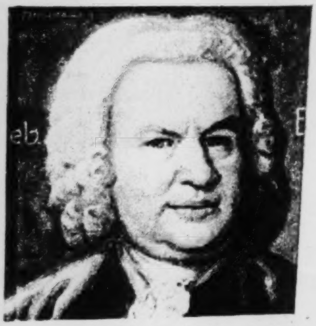
...Stuck in a bar with a flip flop!
...I knew I should have debugged the psychological profile modules...

Record Pick, continued...

Liberace of the organ." Included are Bach's "Toccata and Fugue in D" (naturally), Widor's stirring Toccata from "Symphony #5" and five other pieces by Bach, Widor, Mozart and Clarke.



J.S. Bach

Crystal Records

Prunes. "In Norway, the word *Sviske* (Prune) in musical circles means a piece of music familiar and/or easy to listen to." Here we have an unusual trio of horn, bass horn and piano performing Bach's "Air for the G-String," Schubert's "Serenade" and three other pleasant pieces by little-known composers.

Trio Sonatas. The Los Angeles Baroque Players on this record consists of the "more traditional" violin, flute (the melody voices), cello (low voice) and harpsichord (harmonics). The Bach "Trio Sonato in C" is a traditional church sonata as is the Fasch trio in G. The Fesch "Trio Sonata IV in G" is more lighthearted while Stamitz reflects an early classic style. The performances are sensitive and intuitive.

Crystal has many other unusual chamber music disks in their catalog. Somewhat annoying is their practice of mixing baroque and very modern on the same record, but if you like both they have much to offer.

Crystal Clear Records (HQ)

1685: A Sound Odyssey. Fernando Valenti plays the solo harpsichord in this record. The eight pieces range from the pre-baroque Purcell "Suite in G" to familiar baroque pieces of Bach, Scarlatti, Handel and Rameau to the late baroque "Sonata in G" by Soler, a pupil of Scarlatti. A sonic delight.

The Digital Fiedler. Released in both digital and direct-to-disk versions, this record features Arthur Fiedler conducting the Boston Pops in Tchaikovsky's "Capriccio Italien" and Rimsky-Korsakov's "Capriccio Espagnol." During playback, Fiedler, then 82, clapped his hands and exclaimed . . . "Listen to that!" . . . "No, hiss, by God!" . . . "That's marvelous!" I couldn't have said it better.

Delos (HQ)

Vivaldi: The Four Seasons. Every record library probably has at least one recording of Vivaldi's best known work. I had two. Why consider another? Simply because this recording by Gerald Schwarz and the Los Angeles Chamber Orchestra is the purest I have heard—not only because of the digital recording, but the precision playing.

I recently heard the Los Angeles Chamber Orchestra in Avery Fisher Hall and I can honestly say that the richness of their sound is well captured on this record.

I previously reviewed several other Delos records and remarked on their extensive catalog of music for brasses. Their new releases have broadened into most of the chamber music area. Their double-fold packaging is beautiful and the jacket notes focus on the music rather than the recording technique. My applause to them.

Desto

Desto's catalog focuses on early music: medieval, renaissance and baroque. If you're not familiar with early music, I recommend Desto's cat. MR-1, a sampler of medieval and renaissance sounds for the bargain price of $2.98. Also a bargain in these days of LP's with 12-15 minutes of music per side is Desto's practice of frequently offering 25-30 minutes per side.

Mediaeval and Renaissance Sounds. Of the six albums in this series, I particularly like Vols. 4 and 6 although all are interesting and diverse. Instruments such as the krummhorn, sackbut and kortholt create joyfully noisy sounds rarely heard today. If your image of early music is one of solemnity and reverence, cast it away—these records are of dances, songs and festivities. This is the popular music of the 13th century, not that for the theater or court. And it's delightful.

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"It says 'this programming is brought to you by the Letter 'A' and the number '8'!"

Lute Music of J.S. Bach. One of the oldest known musical instruments, the lute, is the forerunner of today's banjo and guitar. Not all the pieces on the record were composed for the lute, but soloist, Walter Gerwig, interprets them in a rich way that shows a profound love of the music.

Digitech (HQ)

Digital Hits of 1740. This is a personal favorite. Yes, I have at least three recordings of everything on it, but one just can't have too many of the Pachebel Canon, Mouret Rondeau (Masterpiece Theater theme), Bach Jesu or Albinoni Adagio. These are not "authentic" performances, but thoroughly modern ones to really show off a sound system.

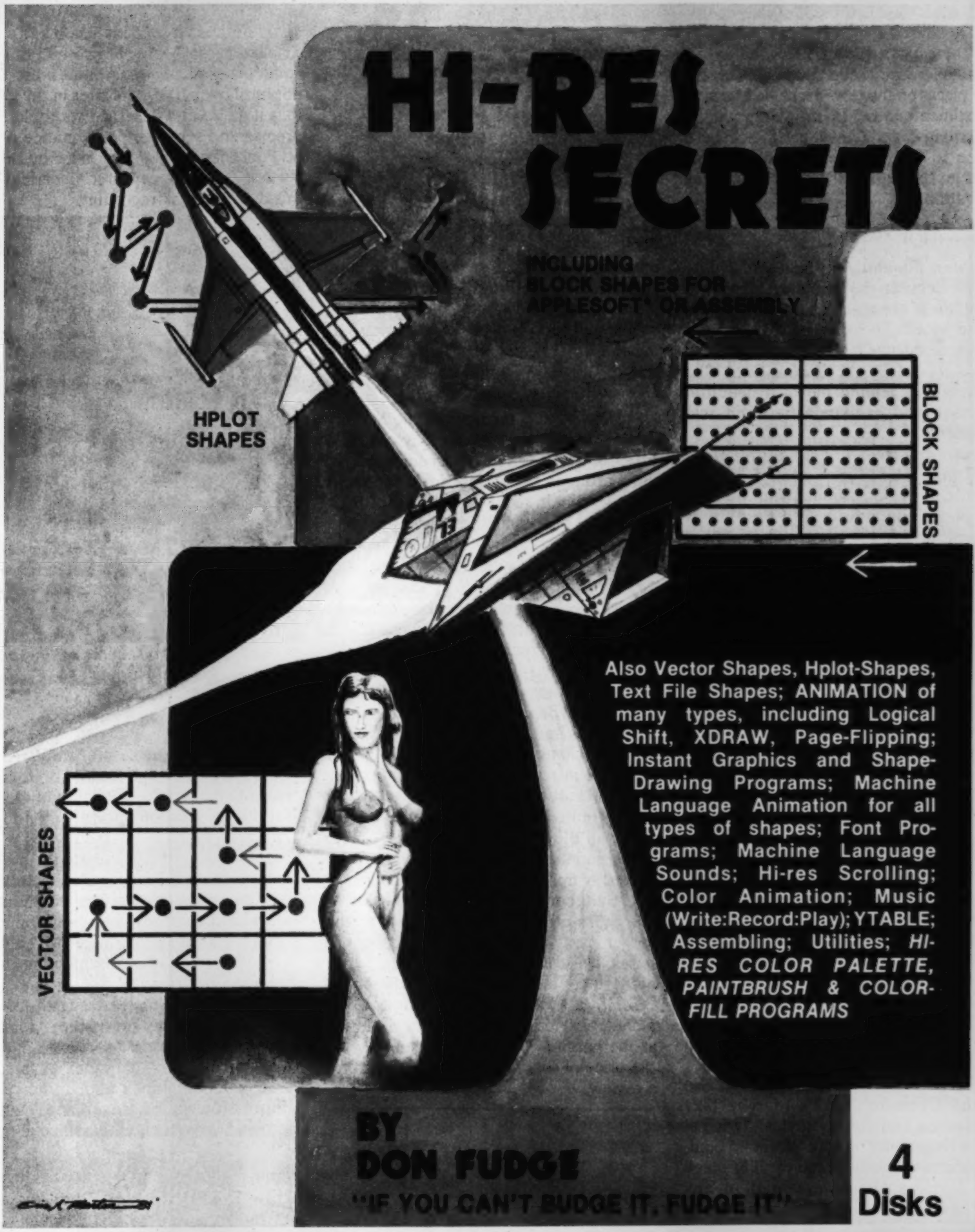
Empire Brass Quintet Encores. The five young musicians of the Empire Brass Quintet have achieved a well-deserved reputation for virtuosity, versatility and vitality. So often, one or two instruments dominate in brass groups. Not so with the EBQ. And nowhere is their well-balanced tone shown to better advantage than in this album of Gershwin, Bernstein, Scott Joplin and Sousa. A perfect summer evening concert.

Finnadar Records (HQ)

Chopin, Prokofiev and Scriabin. This limited edition of 5000 direct-to-disk records by the talented Idil Biret playing the piano is striking in its brillance and clarity. Her interpretations include two Chopin Mazurkas, Scriabin's "Sonata #10" (the sonata of trills) and Prokofiev's "Sonata #2" (rediscovery of the pianos percussiveness.

Foundation

Music From The Water Gap. Every summer Edward Brewer leads a group of chamber musicians in a series of weekly concerts by a slow-moving tributary of the Delaware River near the Water Gap. The setting is magnificent and I make a point to attend as many of these free summer concerts as possible. Most of the pieces performed are familiar but Brewer occasionally throws in a pleasant surprise.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Record Pick, continued...

So it is with the first piece of the record, an oboe quartet by Luigi Gatti. Although in the style of Mozart and Haydn, Gatti's works have never been recorded before. Other pieces on the record include Mozart's "Divertimento in D," Bach's "Harpsichord Concerto in E"and (inevitably?) Pachebel's "Canon in D." The record costs $6.00; profits go to the Artists For Environment Foundation.

Gasparo (HQ)

Brahms: Sonatas for Viola and Piano, Op. 120. Between the baroque and modern period, there are precious few solo pieces for the viola. The shining exception is this pair of sonatas by Brahms ably played on this record by the Zaslav Duo. The performances remind me of a beautiful conversational exchange between two instruments.

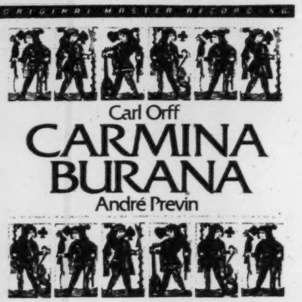
Mozart and Heiden: Quintets for Horn and Strings. The Mozart quintet, K. 407, is a difficult work, particularly in Mozart's time played on a valveless horn. It is charming, stylish and emotional. Bernhard Heiden composed his quintet in 1952; it ranks as one of the few modern compositions I enjoy. In the first movement, I particularly like the suggestion of a distant March in sharp contrast to the expressive romance in the Andatimo movement.

Mobile Fidelity Sound Lab (HQ)

Elgar: Falstaff Symphonic Study, Fantasia and Fugue, The Sanguine Fan. Composed just before the Great War following a period of personal depression, Elgar portrays Shakespeare's Falstaff as generous, funny or vicious, depending upon what the listener wants to hear. Elgar transcribed Bach's Fantasia and Fugue in c minor after his wife's death when all desire to compose seems to have fled. Nevertheless it is a marvelous wedding of his art of the large orchestra to older music, probably appropriate for the brave new world following the Great War. The pieces on this two-record set are competently performed by Sir Abrian Boult and th London Philharmonic.

A Tchaikovsky Spectacular. What else but the Overture "1812", Marche Slav and Romeo and Juliet on this "Original Master Recording?" Andre Previn's recording features the artillery and carillon which have become almost essential to any modern-day recording of this music. However, my personal favorite on this record is Romeo and Juliet with its glowing, melodious love theme.

Carmina Burana was the title given to a 13th century manuscript found in a Bavarian monastery. Carl Orff set the song to swinging, vigorous and, occasionally, clashing music. Scoring is for soloists, large chorus, small choir, boy's voices, large orchestra, two pianos, and multifarious percussion. Andre Previn leads this massive piece, spectacularly put on disk by MFSL's half-speed production of the original master.



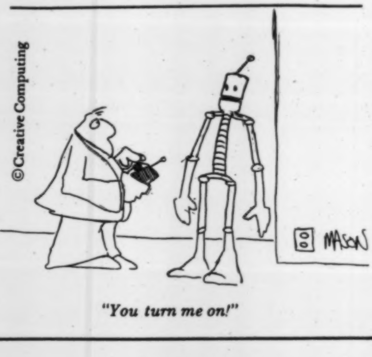
Musical Heritage Society

Having been a member of the Society since its founding, I have today over 220 MHS records. Originally specializing in the baroque, MHS has broadened out considerably in recent years. Out of their catalog of nearly 4000 records it is quite impossible to find two or three favorites to review so I'll mention some of the notable projects of MHS.

Currently, they are undertaking to record all of the Bach cantatas, a herculean effort. Six volumes of sacred music by Vivaldi revealed some splendid and infrequently recorded scores. Releases by little-known composers, Baun (Six Sonatas For Harp and Harpsichord, MHS 4317) and Corrette (Laudate Dominion, MHS 4085), for example, have introduced me to an enormous body of music rarely heard in concert.

Not limited to the baroque era, MHS offers all the Beethoven symphonies and piano sonatas, Haydn symphonies, Prokofiev symphonies, Mozart piano music and Schubert piano works as well as numerous other complete series. Off the beaten path they even have 20-record series, "History of Spanish Music." Best bet is to get their catalog for $2.00.

MHS just announced their first digital record, "250 Years of Great Choral Music," at the bargain price of $8.95, about half the price of some other labels. Watch for a review.



"You turn me on!"

Sound 80 (HQ)

Schubert: Symphony #5. Schubert was only 19 when he composed the much-loved number five of his seven and a half finished symphonies. Performed only by amateurs during Schubert's lifetime, it was not until over 100 years later in the 1930's that it gained its deserved foothold. The precise and sensitive performance of the St. Paul Chamber Orchestra led by Dennis Russell Davies is captured unerringly on this direct-to-disk recording.

Dennis Russel Davies conducting the St. Paul Chamber Orchestra

Telarc (HQ)

Boito: Prologue to Mefistofele, Verdi: Te Deum. Although Italian, Boito looked more to the weight and depth of Germans for his inspiration. Boito's monumental *Faust* was a failure but the revised version, *Mefistofele*, and particularly the prologue won wide acclaim. Verdi's last work, his *Te Deum*, has both festive and mournful parts unlike versions of other composers. Both works are performed with color and breadth by the Atlanta Symphony Orchestra and Chorus under Robert Shaw.

Chausson: Concerto, Op. 21. This unusual concerto for piano, violin and string quartet forms a sort of bridge from the romanticism of Franck (Chausson's teacher), Schumman and Brahms to the impressionism of Ravel and Debussy. Israela Margalit plays the piano and Loriz

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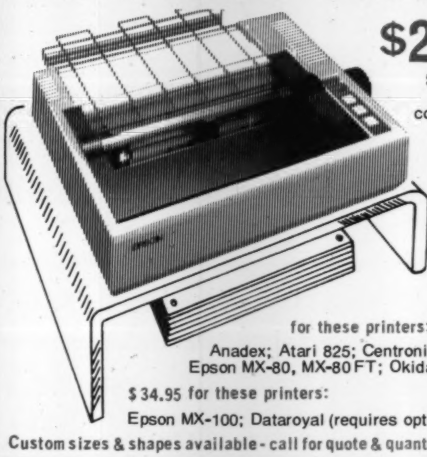

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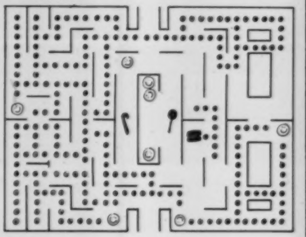

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TRS-80 Mod I/III 48K Disk $59.95 **CP/M 8" Single Density $79.95**

Meet author ARNOLD SCHAEFFER
Attends Georgia Tech, majoring in computer science. First exposed to computers in 6th grade; sold first program at age 16. Characterizes self as "not a good speller", was inspired to write MIZ SPELL when he examined available programming in store, decided "it could have been done much better.

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CIRCLE 318 ON READER SERVICE CARD

Record Pick, continued...

Maazel the violin solo parts. Personally, I feel the digital recording process is almost more beneficial to chamber performances such as this than to "large" pieces. You can almost believe the performance is taking place in your living room.

Titanic

Bach: The Goldberg Variations. Most performances omit the repeats in the variations. John Gibbons, on this disc, does not because, in his words, "hearing the music twice is an advantage if the piece is complex, subtle, original, profound and at the same time terse." Without the repeats, the piece is akin to a half-size replica of a cathedral built from full-size stones.

Banchetto Musicale: Works of Telemann. One of the few permanent baroque orchestras in the U.S., Banchetto Musicale performs all their music on original instruments. My favorite piece is the Overture in D, a late work written when Telemann was 84. To me, it's an exciting work particularly with the prominent role given to two hunting horns in several movements.

The Titantic catalog focuses principally on baroque and early classical chamber music.

Varese Sarabande

Boy With Goldfish. This is perhaps; the most unusual piece in this collection of reviews. The piece is termed a "heroic fantasy for soloists, chorus and orchestra" and is based on the Hawaiian Legend Paintings of John Thomas. The seven incredibly colorful paintings and narrative poem of the legend are reproduced in full-color on the double jacket. The orchestra is augmented by Hawaiian percussive instruments that I can't begin to describe. Most impressive!

BOY WITH GOLDFISH
LEE HOLDRIDGE • THE LONDON SYMPHONY ORCHESTRA

1750 Arch Records

This label focuses principally on never or seldom-recorded works of all musical periods. Hence, the two reviews below are merely a sampling of a very diverse line.

Dowland: Fantasies and Dances for the Lute. Unusual for the age (circa 1600), Dowland travelled to France, Italy and lived in Germany and Denmark as well as his native England. Hence, these pieces incorporate many varied styles of lute playing. They include fantasies, pavans, galliards, an almand and a jig. A quite delightful record.

A Night in the Garden Court. This is a collection of 11 varied works played by the San Francisco String Quartet. Most familiar are Dvorak's "Humoresque," Pachelbel's "Canon in D," and two andante cantabiles by Haydn and Tchaikovsky. Intermingled are the gypsy-like "Csardas" by Monti and "Hora Staccato" by Dinicu-Heifetz. Nice music from a more gracious world than 1981.

Addresses

American Gramaphone Records
Distributor:
Precision Sound
24310 Second Place West
Bothell, WA 98011

Chalfont Records
(see Varese Sarabande)

Crystal Records, Inc.
2235 Willida Lane
Sedro Wooley, WA 98284

Crystal Clear Records, Inc.
P.O. Box 3864
San Francisco, CA 94119

Delos
Distributor:
Supersounds, Ltd.
2210 Wilshire Blvd, Suite 315
Santa Monica, CA 90403

Desto
Distributor:
CMS Records, Inc.
14 Warren Street
New York, NY 10007

Digitech
Distributor:
Sine Qua Non Productions, Inc.
25 Mill Street
Providence, RI 02904

Finnadar Records
Distributor:
Atlantic Recording Corp.
75 Rockefeller Plaza
New York, NY 10019

Foundation Records
Artists For Environment Foundation
Walpack, NJ 07881

Gasparo
P.O. Box 90574
Nashville, TN 37209

Mobile Fidelity Sound Lab, Inc.
P.O. Box 919
Chatsworth, CA 91311

Musical Heritage Society
14 Park Road
Tinton Falls, NJ 07724

Sound 80
2709 East 25th Street
Minneapolis, MN 55406

Telarc Records
Distributor:
Audio Technica
1221 Commerce Drive
Stow, OH 44224

Titanic Records
43 Rice Street
Cambridge, MA 02140

Varese Sarabande Records
Distributor:
Discwasher
1407 No. Providence St.
Columbia, MO 65201

11750 Arch Records
1750 Arch Street
Berkeley, CA 94709

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...O. Gllins

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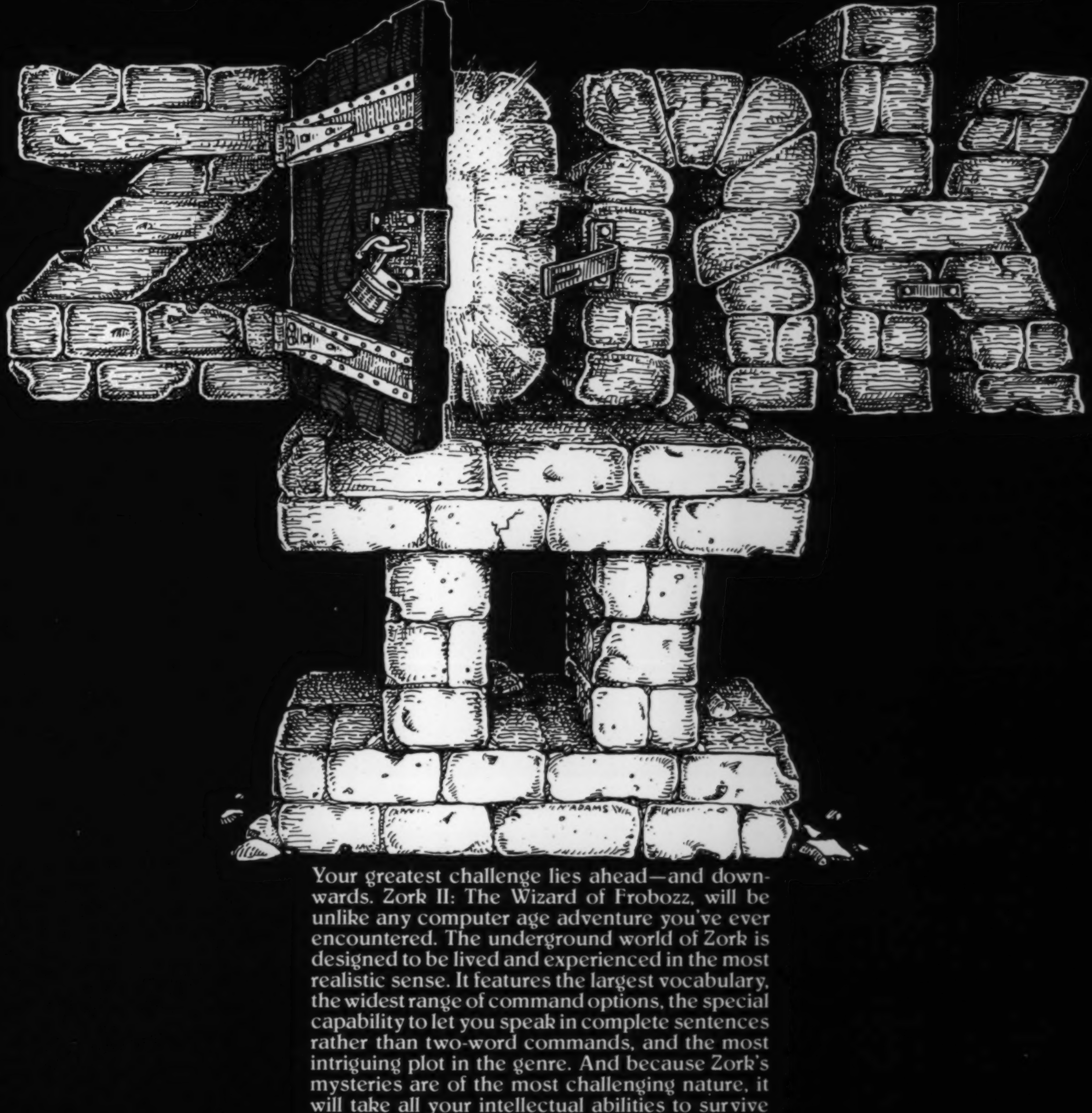


Your greatest challenge lies ahead—and downwards. Zork II: The Wizard of Frobozz, will be unlike any computer age adventure you've ever encountered. The underground world of Zork is designed to be lived and experienced in the most realistic sense. It features the largest vocabulary, the widest range of command options, the special capability to let you speak in complete sentences rather than two-word commands, and the most intriguing plot in the genre. And because Zork's mysteries are of the most challenging nature, it will take all your intellectual abilities to survive and emerge victorious from the Great Underground Empire.

Zork II is the extraordinary successor to Zork I, which hit #4 on the SOFTALK Top 30 in its first month on the market. Both run on 32K Apple II's with a 16-sector disk drive. And both are available now for Christmas.

The door to Zork beckons you. Look for it at your local computer store today.

INFOCOM

Zork is a trademark of Infocom, Inc.

Infocom, Inc., 6 Faneuil Hall Marketplace, Boston MA 02109

Apple II is a trademark of Apple Computer Corp.

CIRCLE 280 ON READER SERVICE CARD

The West Coast Computer Faire Moves to the West End of London

The 4th Personal Computer World Show

10-12 September 1981, Cunard Hotel, Hammersmith, London W6

David H. Ahl

Why should an American magazine report on a British computer show?

Three reasons: 1) Many manufacturers introduce new products in Europe before bringing them to the United States. Some of these products were at the show. 2) Other new products, which are not likely to be introduced into the United States in the near future, use state-of-the-art technology and principles which are of interest to anyone involved in the computing field. 3) The PCW show is one of the best European shows, conducted in the traditions of the highly successful West Coast Computer Faires and, as such, is significant in the field of personal computing.

I will make no attempt to report on every exhibitor but rather will focus on some of the highlights and "significant" products at the show.

By anybody's measure, the show was an incredible success. In talking with the other exhibitors on setup day, we all expected that Thursday would be rather slow as it had been last year, that Friday would pick up a bit, and that Saturday would be a really big day. We were wrong.

The show opened at 10:00 AM on Thursday. By 11:00 AM the queue stretched from the front door of the hotel around the entire hotel and far up into a housing area in Hammersmith. All the parking areas within a one mile radius were completely filled. The buses and underground coming into Hammersmith were crowded to capacity—mostly as a result of the PCW Show.

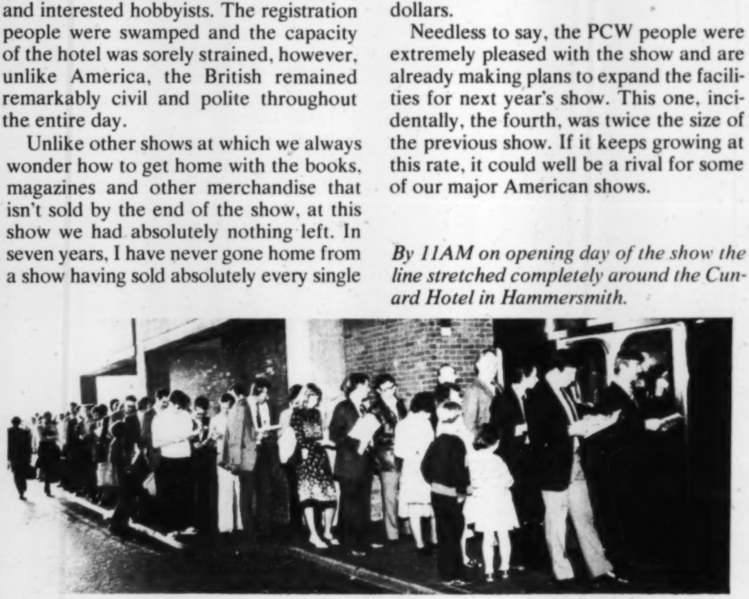
By two in the afternoon it was all but impossible to move through the rather narrow six foot aisles.

Friday, it calmed down a bit, but Saturday all hell broke loose. Many groups outside of London had arranged buses to bring in computer clubs, school classes, and interested hobbyists. The registration people were swamped and the capacity of the hotel was sorely strained, however, unlike America, the British remained remarkably civil and polite throughout the entire day.

Unlike other shows at which we always wonder how to get home with the books, magazines and other merchandise that isn't sold by the end of the show, at this show we had absolutely nothing left. In seven years, I have never gone home from a show having sold absolutely every single book, magazine, T-shirt, catalog, etc. It was a euphoric feeling as I downed a few pints with the PCW crowd after the show to realize that I had no worries about shipping material to our agent in Britain or back home, that I didn't have to come back on Monday and pack up, and that the only thing left to do was to convert a substantial number of pound notes into dollars.

Needless to say, the PCW people were extremely pleased with the show and are already making plans to expand the facilities for next year's show. This one, incidentally, the fourth, was twice the size of the previous show. If it keeps growing at this rate, it could well be a rival for some of our major American shows.

By 11AM on opening day of the show the line stretched completely around the Cunard Hotel in Hammersmith.



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CIRCLE 150 ON READER SERVICE CARD

Show, continued...

Acorn Computers

By far the most crowded stand (in Europe a booth is called a stand) at the show was that of Acorn. Acorn was showing, for the first time, the BBC Microcomputer System. The system is based on a 6502A (same as Apple, Atari, PET, etc.) with up to 48K of memory, a 73-key keyboard, including 10 user-definable function keys and four cursor control keys. The display features mixed high resolution graphics with upper and lower case text. It has color in all eight display modes. The highest resolution mode has 640 x 256 pixel resolution with two colors or 80 characters x 32 lines of text. Medium resolution mode has 160 x 256 pixels with sixteen colors and 20 characters x 32 lines of text. It also has a teletext display mode of 40 characters x 25 lines. It can handle programs from audio cassettes at both 300 and 1200 baud and provides motor control for standard cassette recorders.

Acorn's BBC microcomputer has spectacular graphics at an attractive price.

The machine has a three-voice music synthesis unit with full envelope control to feed an internal loud speaker. It has both parallel and serial line printer interfaces. It also provides a serial interface to the RS-423 standard. This is a new standard which has been designed to be interchangeable with RS-232C but offers considerably enhanced specifications in maximum cable length and data transfer rates. The machine also has four analog inputs for game paddles or control applications.

The system and applications software is fundamentally modular. A 16K ROM contains a machine operating system. This system supports an event timer, four channel analog-to-digital converter, keyboard and keyboard buffer, music tone generator and buffer, serial input/output interfaces and a parallel input/output port.

The Basic interpreter is effectively MicroSoft Basic with several powerful extensions including longer variable names, integer floating point and string variables, multi-dimension arrays, extensive string handling capabilities and multi-line string functions. A very powerful capability is full recursion on all functions and procedures. It also has Algol-like constructs including If... Then... Else... and Repeat... Until. Like Algol and Pascal it has both procedures and local variables.

The BBC microcomputer is likely to be increasingly important in the future. Just because the BBC has selected Acorn to produce the first computer to their specifications, doesn't mean that other manufacturers cannot also produce a BBC-compatible machine. My guess is that they will do so and that within a few years the BBC Basic and other specifications will become standard on all small British-made microcomputers. Since this is fundamentally MicroSoft Basic with some extensions, it is reasonable to expect that these standards will creep over to America.

Acorn Computer Ltd., 4A Markethill, Cambridge CB2 3NJ, England.

Sinclair

Probably the person most miffed about not getting the contract to produce the first BBC machine is Clive Sinclair. We saw Uncle Clive, as he is sometimes called by our British friends, wandering about the show but he was unwilling to comment about his future plans. However, rumor has it that the ZX82 will be fully BBC-compatible, will be considerably cheaper than the Acorn version, and will be available sometime in mid to late 1982.

For the entire duration of the show, people were queued four and five deep around the Sinclair stand waiting to make purchases. Judging from the number of people I saw walking around with a ZX81, 16K memory box or ZX81 cassettes under their arm, the Sinclair people must have done exceptionally well.

Biggest attraction on the stand was the new ZX81 printer which offers full alphanumerics and graphics for £49.95. The printer is a thermal device which uses aluminized paper and essentially prints a copy of anything on the screen. While we have seen this capability previously in $600plus printers it is quite amazing to see it in a printer the size of a paperback book selling for about $100.

Sinclair Research Ltd., 6 Kings Parade, Cambridge CB2 1SN, England.

Data Applications

The handsome DAI personal computer was being shown running a wide variety of software demonstrating educational, scientific and commercial applications. Based on an 8080A, the machine has 48K of user memory and a resident semi-compiling high speed basic with floating-point mathematics built in. The display is one of the few that provides sixteen colors in the highest resolution mode, 255 x 335 pixels. In addition, it has two lower resolution modes, a character mode (60 characters x 24 lines) with both upper and lower case and split screen modes which

Bird's eye view of the Creative Computing sales tables.

THE BACKBONE OF YOUR SYSTEM

The Heath/Zenith 19 Smart Video Terminal gives you all the important professional features, all for under $700.* You get the flexibility you need for high-speed data entry, editing, inquiry and transaction processing. It's designed to be the backbone of your system with heavy-duty features that withstand the rigors of daily use.

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Pick the store nearest you from the list on page 33. And stop in today for a demonstration of the Heath/Zenith 19 Smart Video Terminal. If you can't get to a store, send $1.00 for the latest Heathkit® Catalog and the new Zenith Data Systems Catalog of assembled commercial computers. Write Heath Co., Dept. 355-846, Benton Harbor, MI 49022.

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Z-80 microprocessor-control makes the Heath/Zenith 19 capable of multitude of high-speed functions. It's the only terminal with ROM source code readily available.

Complete ASCII character set including upper case, lower case with descenders, and special graphic symbols.

80 character by 24 line format, plus 25th line for operator messages and prompts.

Professional quality keyboard, standard typewriter layout, 72 keys, including 12 special function keys.

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Cursor and special functions are accessible by keyboard or computer, using either DEC VT-52 or ANSI Standard protocols.

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*In kit form, F.O.B. Benton Harbor, MI. Also available completely assembled at $995. Prices and specifications are subject to change without notice.

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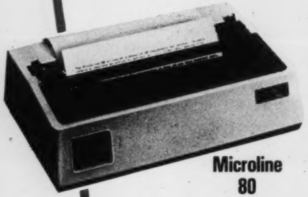
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- 132-column compressed print
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	LIST
ORS-256 (256 Character Memory)	$109.00
MSP-100 (Unbuffered, Switch Select Data Rates)	$120.00
MSP-200X (200 Character Memory)	$215.00
MSP-2000X (2000 Character Memory)	$300.00
Other available options:	
Adjustable Tractor Feed - Model 54100201	$ 50.00
TRS-80 Parallel Output, cable to printer	$ 35.00
Ribbons	$ 3.00

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Microline 82A

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Microline 82A – 80-column, 120 characters per second	$ 649.
Tractor Optional	$ 50.
Microline 83A – 136-column, 120 cps, built-in tractor	$ 995.
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CIRCLE 233 ON READER SERVICE CARD

The DAI personal computer is an attractive all-in-one unit.

mix graphics and characters. It also has three built-in tone generators and one noise generator, dual audio cassette interfaces with motor control, stereo hi-fi output channels (!), game paddle inputs, three programmable input ports, and an RS-232 serial interface with programmable baud rate.

DAI Basic is unique to the DAI computer. While it has many extensions over "standard" Basic, some of the commands and functions will be unfamiliar to those people used to MicroSoft Basic. It has four variable types including integer, floating-point, hexadecimal, and string. It includes arithmetic and Boolean operators, four graphics commands and three sound commands as well as 40 functions (compared to a more typical 20-25 functions in other Basic implementations).

Price of the DAI personal computer is £595 (about $1200). We understand that arrangements are being made to export it to the United States.

Data Applications (UK) Ltd., 16B Dyer Street, Cirencester, Gloucestershire, GL7 2PF, England.

Commodore Business Machines

Commodore was probably the best represented company at the show with stands on both floors, all showing the full range of CBM, PET and the VIC-20 computers and peripherals.

This may be my imagination, but it seemed that there were more software packages available for the VIC-20 in England than in the United States. Adjoining the Commodore stand was one sponsored by the VIC center, the UK's first store devoted to the VIC-20 computer.

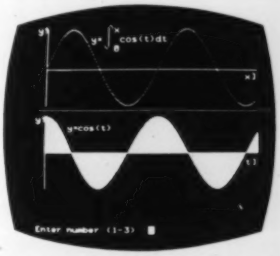
The PET computer is far and away the best selling small computer in Britain. The continued support given to the PET, and now the VIC, by Commodore and its dealers indicate that this domination will probably continue for some time.

Commodore Business Machines Ltd., 818 Leigh Rd., Slough Trading Estate, Slough, Berks, England.

Other Computers

Transam Computers were showing the latest peripherals for their Tuscan S-100 system. This is a high-end Z80-based system which runs CP/M and supports several Winchester hardware disks, high speed communications, and A to D.

Research Machines also make several high-end systems including their 380Z and 480Z computers. These are both Z80 based and have high resolution text and graphics modes. Research Machines introduced Varitext at the show which allows software-switchable 80 or 40 character per line displays. This allows the user to choose the most appropriate line length and character size for various applications such as programming, classroom presentation, laboratory control and word processing. It also includes features such as windowing, highlighting, 128 user-defined characters, selective dimming, smooth scrolling, and fast screen filling.



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Enter number (1-3)
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Display produced by the Research Machines 380Z.

NEC was attracting a great deal of attention with their PC-8001 desktop computer. Apparently this is now the best selling personal computer in Japan and they are determined to repeat this success in Europe and the United States. We were very impressed with the PC-8001 when we reviewed it and expect its acceptance will live up to NEC's expectations.

Ingersoll Electronics is now the exclusive sales distributor for Atari 400 and 800 computers in the UK. Getting the most attention were the software packages from Thorn/EMI such as Darts and Pool (these packages are available in the USA from Creative Computing).

Tangerine Computer Systems was showing several new peripherals for their Microtan line of computers including a high resolution graphics card and 6502 controller card. More interesting however, was the "Tantel" Prestel Adapter. This functions as a full Prestel adapter and also allows communications to a computer through a cassette interface port which enables pages of information to be down-loaded into the computer memory for further processing (more about Prestel will appear in a future issue of *Creative Computing*).

Peripherals

While many peripherals were being shown at the PCW Show, the one getting the most attention was a speech synthesizer board produced by Arfon Microelectronics Ltd. The unit comes with interfaces for the Apple, PET, TRS-80, and RS-232 systems. The AML speech synthesis system is based on the National Semiconductor "Digitalker" system chip set. The card contains a speech processor chip and two 64K bit speech ROMs which contain a vocabulary of 156 words and subsounds. Also included on the card are a power amplifier, small loudspeaker and interface circuitry.

The system uses speech compression synthesis techniques. This technique dramatically reduces the amount of memory required to store speech when compared

The show attracted a wide cross section of visitors—businessmen, educators, hobbyists and people who were just curious.

The show was also the site of the 2nd European Microcomputer Chess Championship. (Full report coming up.)

Show, continued...

to other systems such as digitization, pulse code modulation, and adaptive code pulse code modulation. The quality of the output speech was outstanding and the programming required to integrate the use of the unit into other programs is minimal.

US prices are approximately $170 for the Apple card and $240 for the PET, TRS-80 or RS-232 system. Arfon Microelectronics Ltd., Cibyn Industrial Estate, Caernarfon, Gwynedd, Wales.

Software

About half of the software being shown was imported from the United States and has already been described on these pages. The balance of the software was produced in the UK but is unlikely to be exported. There are several reasons for this. First, business-oriented software does not seem to be highly transportable beyond national boundaries due to different ways of doing business, different income tax and sales requirements, and the like. Another reason is that the software companies in the UK, like those in the United States three or four years ago, tend to be rather small. At this point in their life cycle, most of them have a difficult time just doing business at home and haven't the resources or expertise to do business abroad. The exceptions are companies such as Thorn/EMI who have arranged for licensing or distribution of their products through major manufacturers and software vendors in other countries.

One notable exception is DJ AI Systems Ltd. who have been marketing "The Last One" system worldwide. This is a program generator system which will write complete programs using instructions in plain English, thus supposedly removing the requirement for the user to learn a computer language. We had a preliminary review of "The Last One" in the August issue of *Creative Computing*, however, we expect a more comprehensive review in a future issue.

Apfeldeutsch (means German by Apple) is a new concept in language learning. It consists of nine diskettes of tests and teaching routines with all instructions in English, an instruction booklet, six audio cassettes recorded in German with dialogues and listening comprehension tests, one text book (all in German with printed versions of the dialogues on the texts, exercises, and background material) and a workbook in English with grammatical explanations, exercises and a glossary.

While the user will not be proficient at speaking German after taking this course, it is an excellent beginning to learning the language. It can go a long way to helping one speak and be understood while traveling in German speaking countries, in coping with applications forms and officialdom, and in talking to ordinary people.

Price in the US will be approximately $200. For more information, contact Wida Software, 2 Nicholas Gardens, London W5 5HY, England.

"How's the programming going?"

Computer Clubs

Britain's Amateur Computer Club was founded in 1972 which probably makes it the oldest surviving amateur computer club in the world. The ACC organized a grouping of amateur computer clubs for this show. Sixteen separate user groups exhibited out of the over 200 user groups in the country. The overall theme was "Join a computer club before you buy your computer" and the clubs seemed quite successful at convincing people to do so.

Adjacent to the Computer Clubs area was an exhibit area sponsored by the 20 some-odd local ComputerTowns throughout the UK. These are open-to-the-public computer centers modelled on Bob Albrecht's ComputerTown in California and staffed by volunteers. For one reason or other, the ComputerTown concept has caught on much more strongly in the UK than it has in the US and these centers are doing a thriving business throughout the country. They are supported in spirit and in editorial coverage by *Personal Computer World* magazine whose previous editor, David Tebbutt, was a strong supporter of the Computer Town concept. David, incidentally, recently left PCW to form his own software company of which we'll be hearing more in future.

All in all we were extremely pleased with the show and you can be sure we will be back again next year.

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Betsy Staples

Short skirts, antiquity, and limitless civility were among the elements that contributed to our culture shock in England.

When we finally set foot on *terra firma* at London's Gatwick Airport—12 long hours after boarding in New York—we almost immediately experienced a sense of *deja vu*. Many of the young women were clad in skirts short enough to qualify them for life in the late 60s.

Wherever we travelled, we noticed that those young people who were not dressed in pants had chosen very tight, mid-thigh length skirts. And whether they wore pants or skirts, all the fashion-conscious were shod in pointy-toed, pointy-heeled shoes, frequently metallic silver or gold in color.

This year we also noticed many more of what I can only describe as "punk people." Even in the country, miles from London, we saw young men and women with tatoos on their faces, arms and who knows where else, wearing skin-tight pants and truly bizarre hair styles. The hair styles ranged from the simple I-forgot-to-comb-it-this-morning to the multi-colored, kinky this-is-what-happens-when-you-stick-your-finger-in-an-electrical-outlet to the easy care POW look. I will resist the temptation to make any further editorial comments on the subject.

Although our purpose was to attend the Personal Computer World Show in London, we arrived a few days early and, despite the warning of our host at the bed and breakfast house where we spent the first night that there was absolutely nothing of interest in that direction, headed south and east to spend some time sightseeing.

By the Sea

We visited the seaside resort towns of Brighton and Hastings which we found charming and sedate by comparison with such American equivalents as Atlantic City and Miami Beach. Although the weather was only pleasantly warm by our standards, the English apparently felt it as a bit of a heat wave, and in Brighton we saw many people sunning themselves in front of little wooden cabanas overlooking the pebbled beach. In both towns, sail boarding seemed to be quite popular in spite of rather rough water and cool temperatures.

On the way to Hastings, we stopped in the town of Lewes which boasts, among other points of interest, a medieval castle and Anne of Cleves's house, both of which provided excellent fodder for the imagination. The description "lord of all he surveys" took on new meaning in the tower of the castle, and from the ground, it was obvious that the holder of the castle had an immeasurable advantage over the attackers below.

Even though things had become more peaceful by the time Anne of Cleves lived in Lewes, we were not envious of the lifestyle to which her home bore witness.

Sunday afternoon found us in Canterbury where we explored the Cathedral and its precincts. Although the interior, with its statues and stained glass windows, is beautiful, we were far more impressed with the architecture as seen from the outside and with the grounds, which include the remains of a monastery.

From Canterbury, we travelled north to Colchester, the oldest continuously occupied town in England. There we were momentarily reminded of our true mission when we saw an Apple computer and IDS Paper Tiger printer perched incongruously on the front desk of the tiny, old hotel at which we stayed.

It seemed improbable that the proprietor would need a computer to keep track of reservations for the fewer than 20 rooms in the hotel, so we asked and were told that he used it to schedule bookings for private parties in the downstairs disco lounge. Of course, we are always glad to see people using personal computers, but this was clearly overkill!

Pizza and Potatoes

In Colchester, we had lunch in a Pizzaland, one of several indigenous fast food chains. The featured item on the menu was a nutritionist's nightmare: two slices of pizza, two baked potatoes and a serving of cole slaw.

We passed up the potatoes and proceeded to explore the museum housed in Colchester's Norman castle and the remains of the town wall left by the Romans.

The following morning we went to the coach station to catch a bus for Cambridge. We had the bus equivalent of standby status since we had not purchased tickets the required 48 hours in advance, and were disheartened to see a troop of 27 teenagers join our queue. A sigh of relief followed quickly, however, when the leader told us that they were a group of German students travelling in England, and that they did not have tickets either.

When the bus arrived, there was plenty of room, so we boarded, then waited while the German teacher and the bus driver discussed the fate of the 27. Finally the driver climbed aboard and drove off, leaving the students standing on the platform.

One of the other passengers inquired about the delay, and the driver said he had not wanted to take the students because he was afraid they would get stuck in Cambridge and he would be blamed. Another passenger asked in a horrified tone if the young people were English. When the driver replied that they were German, she sounded relieved and said, "Oh, that's all right, then." The sins of the fathers are visited upon the sons!

In Cambridge we took a walking tour of the University guided by a rugged-looking woman wearing National Health glasses and sensible shoes. We spent two hours roaming the beautiful campus and learning about education at Cambridge, including the tutorial system, punting, not walking on the grass and who is allowed to use which gardens.

From Cambridge we journeyed back to London to prepare for the show. Everything was in order, and we set up our stand in record time. The show was successful for us in terms of sales, and we enjoyed meeting many of our British readers and contributors.

In London, as in the surrounding countryside, we were very impressed with the civility and general helpful attitude of the British people. Everyone we met, from bus drivers and waiters to the show management and our own subscribers was helpful, tolerant of our ignorance, and extremely polite. Even the bank teller into whose cage we dumped a large stack of bills for conversion at one minute past the closing hour of the bank did not so much as act annoyed.

Their standard of living is far below ours, their telephone system is abominable, and their showers are useless, but we Americans could learn a great deal about making life more pleasant for other people and for ourselves, if we took a few lessons in manners and attitude from the British. ☐

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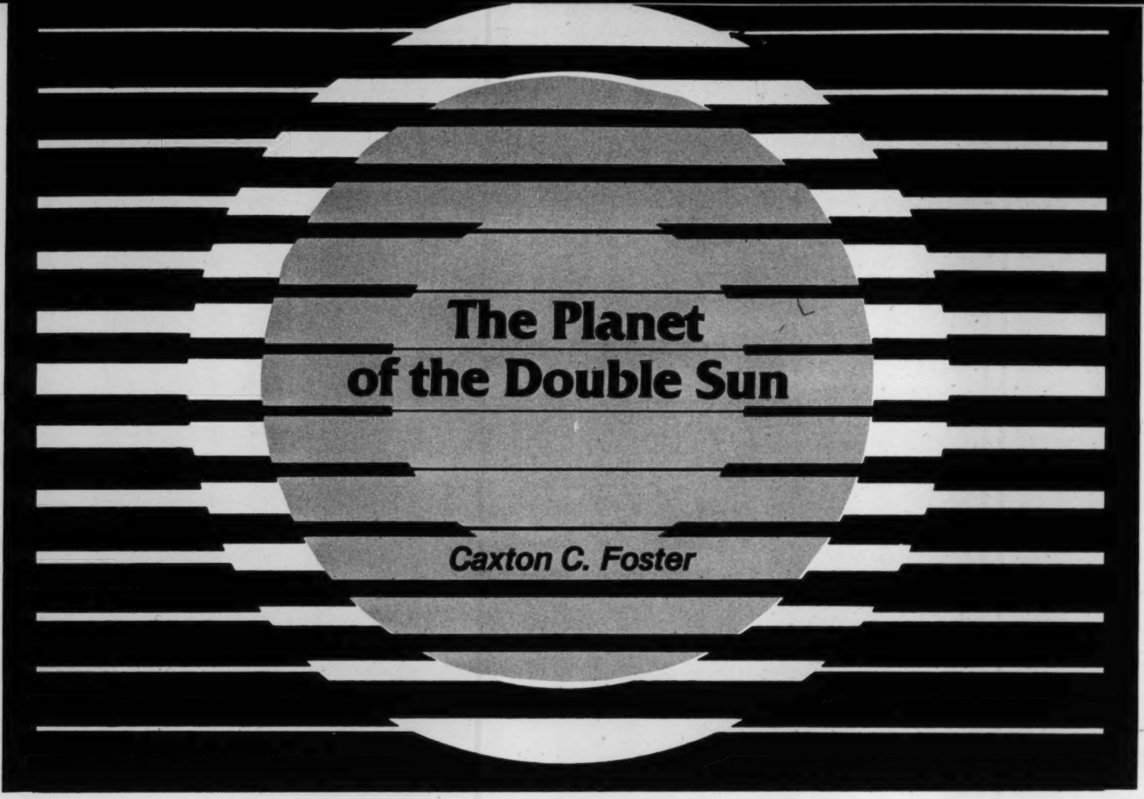

The Planet of the Double Sun

Caxton C. Foster

In many a science fiction story the protagonists find themselves on a planet circling a double or triple sun. The strange multiple shadows, perhaps of different colors, and the spectacle of the suns orbiting around each other provide good and undeniably alien descriptive material for the author, who often gets paid by the word. For many years it was believed that in actuality no stable planetary orbit could exist in a multistar system. Since science fiction is fiction, the authors went ahead calmly with their stories emphasizing the fiction at the presumed expense of the science. Recently, it has been discovered that fiction was not as fictitious as was believed and that indeed there can be stable planets orbiting multiple suns.

New computer studies have shown (1) that if our sun were replaced by two stars 0.4 astronomical units apart (an astronomical unit is equal to the mean distance of the earth from the sun, approximately 93 million miles) each with mass and luminosity of half that of our sun, all the planets except Mercury would survive with orbits almost unchanged and the earth would receive approximately the same amount of radiation as it does now and, hence, would remain at the same temperature it now has.

A second example replaced Jupiter with a star equal in mass and luminosity to the sun. Mars would be lost this time, but the other planets including the earth would remain. Again the earth would not change its temperature substantially.

Figuring that a home computer occasionally ought to be permitted to do a computation and not always be forced to play host to assorted demons and dragons I set out

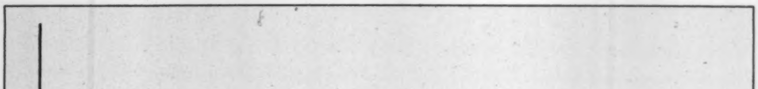

Figure 1. Two bodies in the x-y plane.

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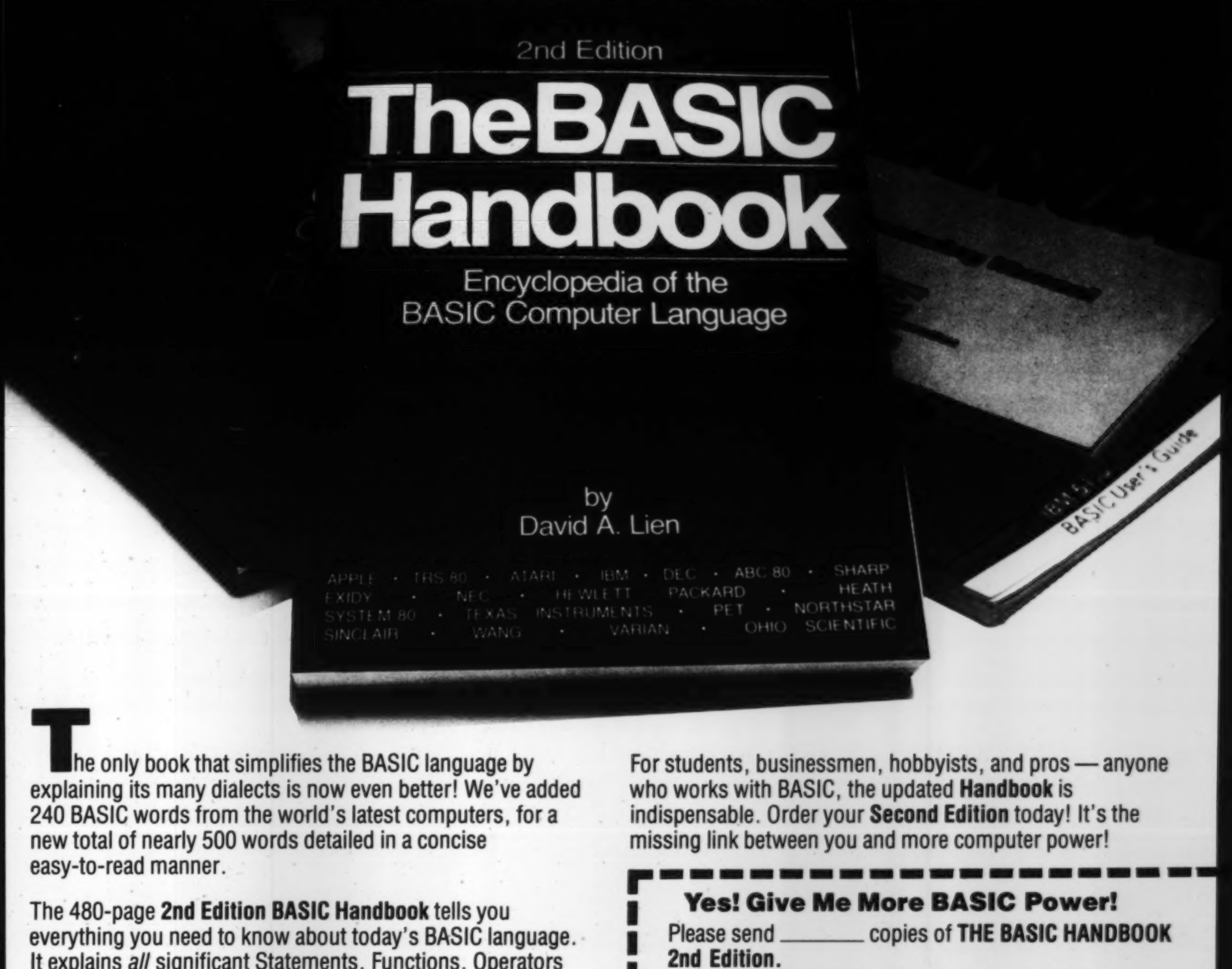

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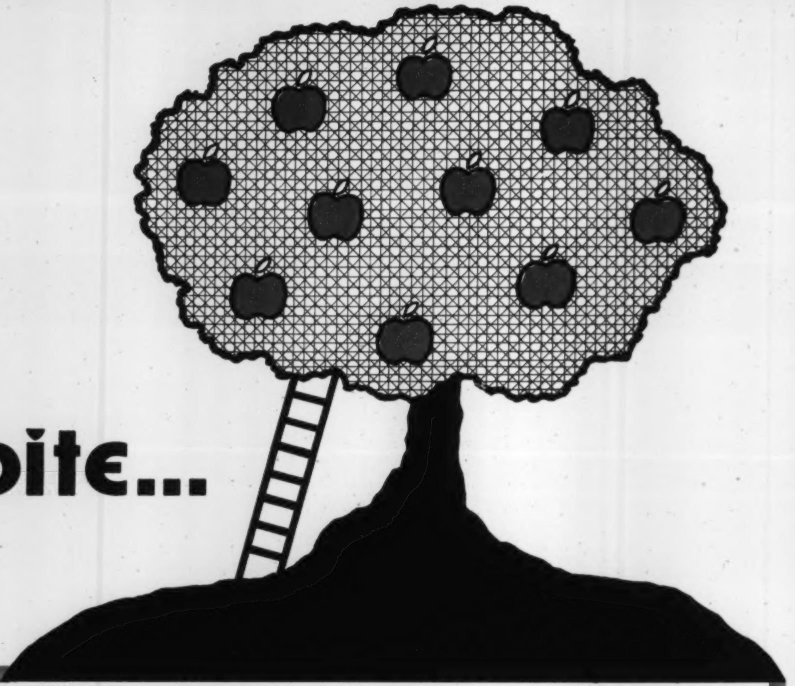

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to build a model of a solar system with one planet and two suns.

Orbital Mechanics

It has been over thirty years since I studied mechanics and orbital dynamics and all I could remember was that every object in the universe attracts every other object directly proportional to the product of their masses and inversely as the square of the distance between them. Thus, if M_1 and M_2 are two masses at distance d from each other the force drawing them together is proportional to:

$$F = k \frac{m_1 \cdot m_2}{d^2}$$

Since we are interested only in general models we will set the constant of proportionality K equal to one. Dredging yet deeper in the river of time I recalled that force equals mass times acceleration, or:

$$F = ma \text{ , or}$$

$$a = \frac{F}{m}$$

So the acceleration that mass 1 will undergo will be:

$$a_1 = \frac{F}{m_1} = \frac{m_2}{d^2}$$

proportional to the mass of the other object divided by the distance squared.

Figure 1 shows two bodies in space. We assume that they are confined to the plane of the paper. The distance d separating them can be calculated using the theorem of Pythagoras:

$$d = \sqrt{(X_1 - X_2)^2 + (Y_1 - Y_2)^2}$$

To simplify our calculations we need to resolve the force F into its X and Y components. See Figure 2. The large triangle is formed by points M_1 and M_2 and lines ΔX parallel to the X-axis and ΔY parallel to the Y-axis. The length of these sides is given by:

$$\Delta X = (X_2 - X_1) \text{ , and}$$

$$\Delta Y = (Y_2 - Y_1)$$

We want to separate F into its components F_x and F_y. The two triangles are similar so we can say that

$$F_x = F \cdot \frac{\Delta X}{d}$$

$$F_y = F \cdot \frac{\Delta Y}{d}$$

Now that the force has been resolved we can also resolve the acceleration into two components parallel to the X and Y axes as:

$$A_x = F_x / M$$

$$A_y = F_y / M$$

Knowing the acceleration in the X direction we can make the approximation that over a short time interval dt the force is constant (because the masses don't move very much if dt is small).

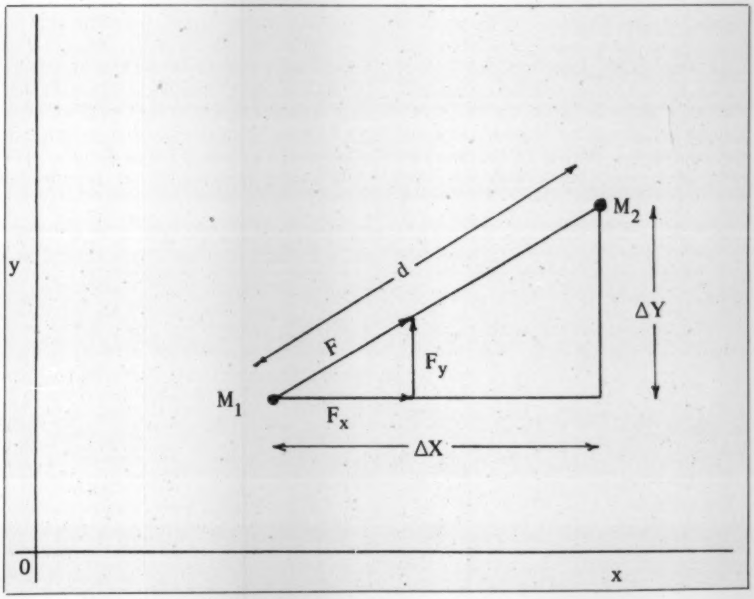

Figure 2. Resolution of force F into its X and Y components.

Thus:

$$V_x = V_x + A_x \cdot dt$$

$$V_y = V_y + A_y \cdot dt$$

Now we further assume that for the short interval dt the velocity (V_x and V_y) is constant so

$$X = X + V_x \cdot dt$$

$$Y = Y + V_y \cdot dt$$

If we make dt very small these approximations will be almost exactly true, but we will have to do a large number of calculations to get any noticeable movement of the masses. A reasonable compromise between accuracy and speed seems to be found in the range of dt between 0.1 and 1.

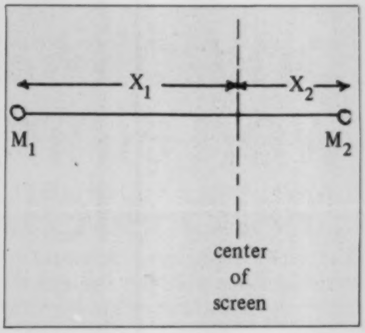

Figure 3. Bringing the center of mass to the center of the screen.

When there are two masses to work with and they are of comparable size they will orbit about the center of mass of the system. If we don't want the center of mass and, hence the two suns, to wander off the screen we must make certain that the initial conditions we give the system (the initial values for X_1, Y_1, X_2, Y_2, V_{x1}, V_{y1}, V_{x2}, and V_{y2}) do not contain a net motion in any direction.

I chose to begin my program with each body lying on the X-axis moving strictly vertically. Therefore, $Y_1 = Y_2 = V_{x1} = V_{x2} = 0$. To vary the initial conditions I read in X_1 and V_{y1}, the position and velocity of body 1. To bring the center of mass to the center of the screen we can look at Figure 3 and calculate that

$$|M_1 \cdot X_1| = |M_2 \cdot X_2|$$

$$X_2 = -X_1 \frac{M_1}{M_2}$$

Similarly to bring the net velocity of the center of mass to zero we have

$$V_{y2} = -V_{y1} \cdot \frac{M_1}{M_2}$$

The Three Body Problem

Two bodies rotating about each other *define* a plane in space. For simplicity and also to reflect the basically planar nature of our solar system we are going to assume that our three bodies move in a common plane.

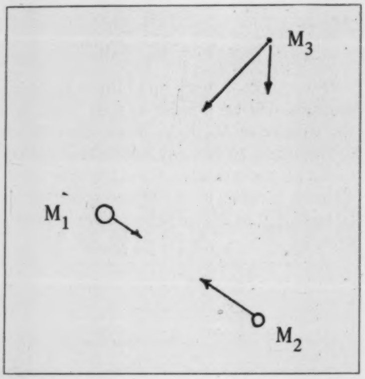

Figure 4. The two suns attract the planet and each other.

Now that we have seen how to handle the two suns we can introduce the planet. We assumed in the program that sun 1 had unit mass and express the mass of the second sun as a multiple of this unit. We assumed that the planet had a mass very much less than that of either sun so that the planet would have no effect on the orbits of the suns. That assumption can be discarded if desired, but in real solar systems it is pretty close to being correct. Given this assumption the two suns attract each other and both of them attract the planet.

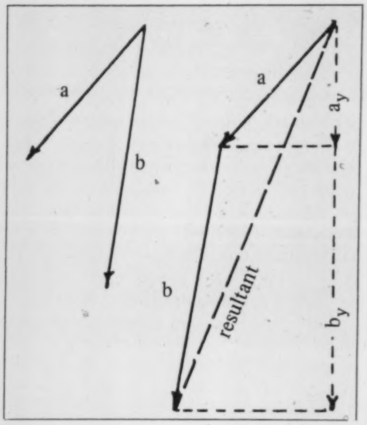

Figure 5. The addition of two forces.

The mutual attraction of the suns we have already considered. Let's look at the planet. There are two forces acting on it. One due to sun 1, the other to sun 2. Each of these forces can be resolved into X and Y components and then the two X components can be added together and the two forces in the Y direction can be added together giving a net X and a net Y force. Figure 5 shows this addition of forces graphically.

Let the Sunshine In

One of the important characteristics of a planetary orbit is the amount of energy received from the sun or suns. Even with a single sun this can be a problem. Figure 6 shows a highly elliptical orbit and it is obvious without any mathematics at all that this planet is going to have cold winters and absolutely ferocious summers. Our old Earth's orbit is only slightly elliptical being about two million miles closer to the sun in January than it is in July. With that small difference the tilt of the axis of the earth is more important than the increased energy received by the total planet and January turns out to be winter in the northern hemisphere and July is usually considered summer. In the southern hemisphere these two effects reinforce each other rather than opposing as they do up here. Given an equal balance of land and water between the two hemispheres (which we don't have), one would expect that the climate of the southern hemisphere would be more extreme than in the north—the summers hotter and the winters colder. Fortunately, the southern hemisphere is (at present anyway) mostly water covered and the high thermal inertia of the ocean smoothes out this variation.

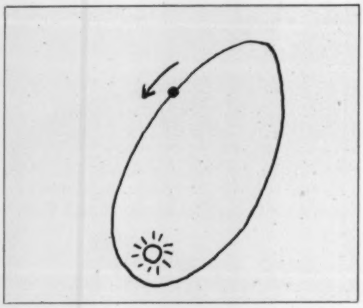

Figure 6. A highly elliptical orbit leading to hot summers and cold winters.

The axis of the earth being tilted relative to its orbit at 23 1/2 degrees means that the sun is high overhead in summer and low in the sky during winter. On the tropics of Cancer and Capricorn the sun is directly overhead at noon on the first day of summer and only about 45 degrees above the horizon on the first day of winter. It is thermal inertia that causes the hottest and coldest parts of the year to lag behind the days of maximum and minimum solar altitude. If the angle above the horizon is 0 degrees, then the surface of the earth receives an amount of sunshine proportional to the sine of 0; or:

$$S = k \sin \theta$$

Taking the first day of summer as unity, then on the first day of winter the amount of energy received from the sun per square meter is about seven-tenths of unity since the sine of 45 degrees is 0.707.

Our hypothetical planet might have an axial tilt as does the earth but we are going to ignore that for now. However, with two suns of possibly different luminosity (energy output) we are going to have variations in solar input (called "insolation") depending on how close we are to the suns. For the planet to resemble the earth this variation probably should not exceed a ratio of 0.7 to 1 over a year period. Short term variations, during the revolution of one sun about the other, might be larger than this because thermal inertia will tend to smooth them out, but a larger annual variation would make the seasons pretty extreme for comfort.

Figure 7 shows the energy radiated from a star intercepted by a unit area at distance r and that same "cone" of energy at distance 2r. At a distance of 2r the cone intercepts an area of four units—twice as long and twice as high—as it did at distance r. So the energy received per unit area from a

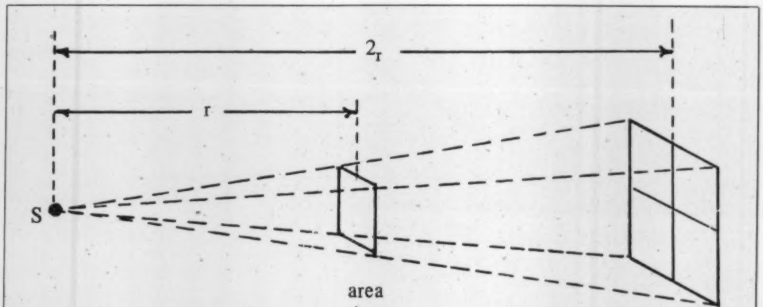

Figure 7. The interception of energy radiated from S.

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point source falls off as the square of the distance from the source.

Two suns in our model solar system may have different luminosity. In real life the brightness of a sun is related to its mass and its age, but we are going to ignore that and take any values we like. Again sun 1 will be assumed to be the standard and have luminosity of 1 while sun 2 has luminosity of L2. Then the insolation will be:

$$I = \frac{1}{R_1{}^2} + \frac{L2}{R_2{}^2}$$

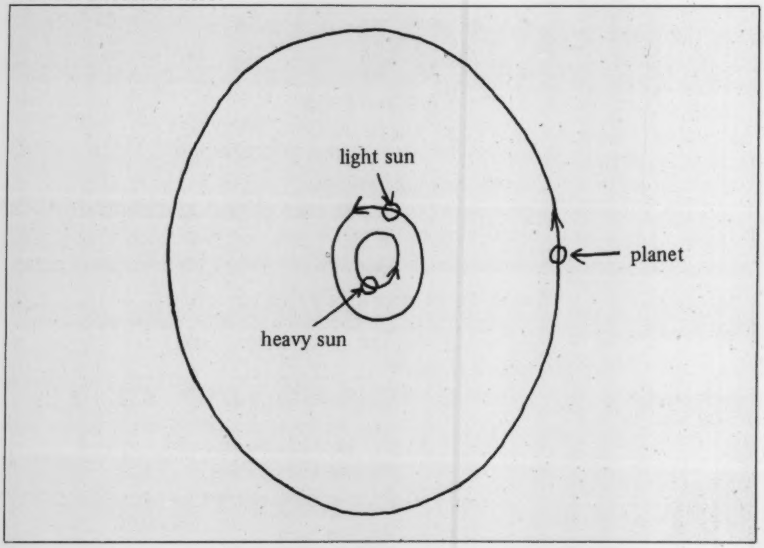
where R_1 and R_2 are the distances of the planet from suns 1 and 2 respectively.

Plotting the Results

My program was written for the PET which, while it has many interesting characters that can be displayed, is not really intended for plotting continuous curves in space. The smallest unit that can be placed at an arbitrary location on the screen is a quarter square. There are, naturally, four of these characters:

▖ ▘ ▝ ▗

The screen itself is 40 characters wide by 25 high, which gives us 80 units of width and 50 of height. We assume that the center of the screen represents the point (0,0) with positive X to the right and positive Y up. The details of the plot routine are presented in the listing and are not of sufficient general interest to warrant discussion here.



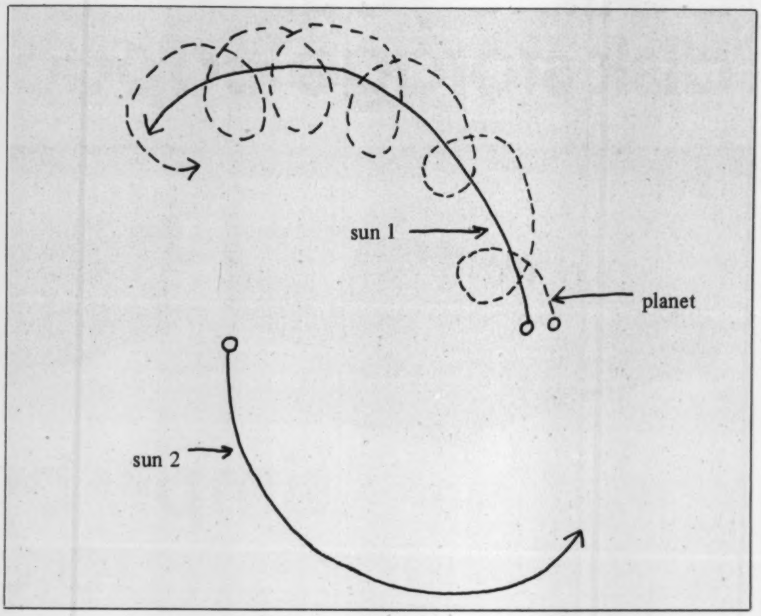
$M_2 = 2$ $X_1 = 5$ $V_1 = .4$

$L_2 = 2$ $X_p = 20$ $V_p = .39$

Max sunshine = .84

Min sunshine = .67

Figure 8. A stable orbit around both suns.



$M_2 = 1$ $X_1 = 15,$ $V_1 = .15$

$L_2 = 1$ $X_p = 20,$ $V_p = .6$

Max shine = 4.52

Min shine = 3.54

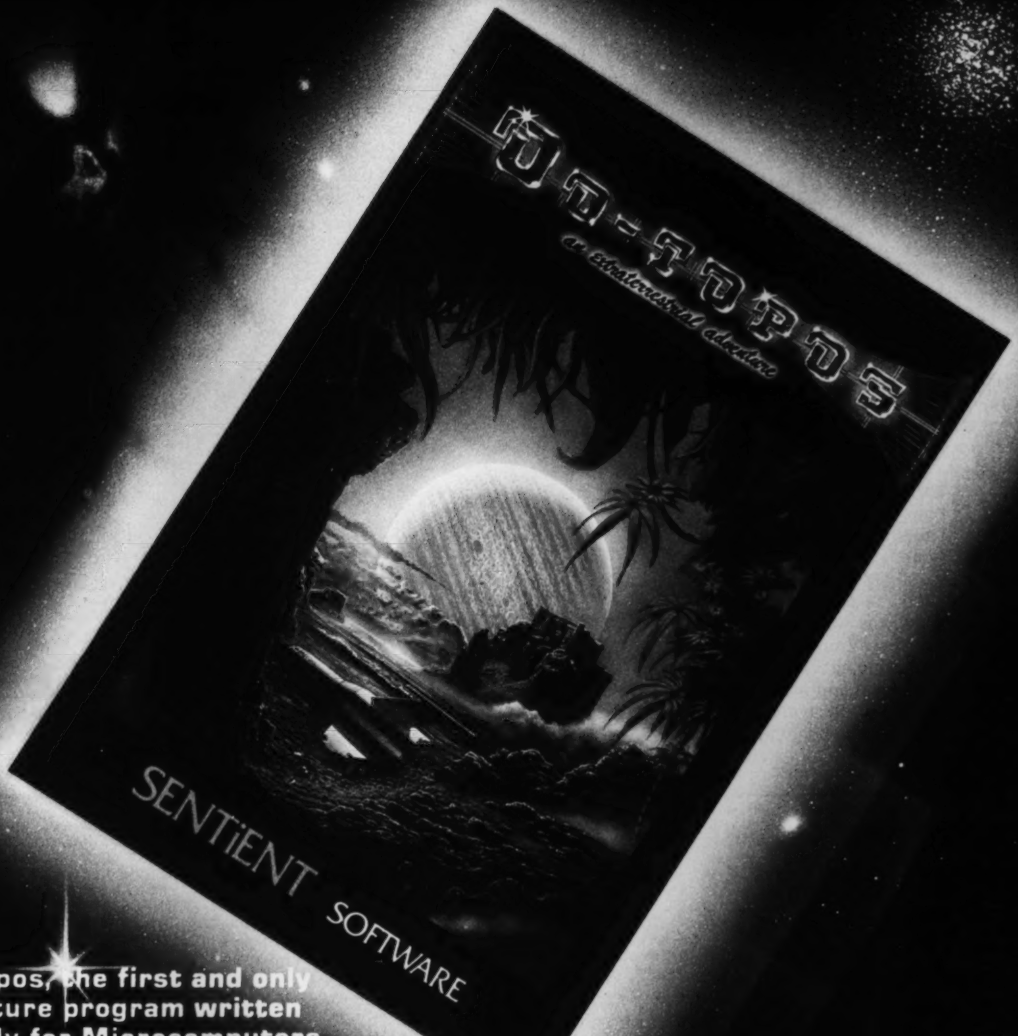
Figure 9. A stable or bit around sun 1.

Some Experiments

I'm still exploring various solar systems whenever I can get time on "my" machine. I'll report on only three here.

System 1. Stable orbit around both suns. (See Figure 8). In this system sun 2 is twice as heavy and twice as bright as sun 1. The initial position of sun 1 is at point 5.0 with an upward velocity of 0.4. Consequently, sun 2 will be located at point -2.0 moving down at 0.2 in order to keep the center of mass in the center of the screen. The planet is located initially at 20.0 moving upward at 0.39. As may be seen from Figure 8, the two suns revolve about their common center of mass in concentric ellipses and the planet about both suns in a larger ellipse. The maximum insolation (sunshine) is 0.84 and the minimum is 0.67 for a ratio of 0.8 to 1 which is smaller than that observed in our own topics. This then would be an eminently liveable planet.

System 2. Stable orbit about one of the suns. (See Figure 9). Here the two suns are of equal mass and luminosity. They revolve around each other in a pair of interlocking ellipses, while the planet traces out a flattened corkscrew path as it revolves about one of the suns. Initial conditions placed sun 1 at point 15.0 moving up at 0.15 and the planet at 20.0 moving up at 0.6. The ratio of minimum to maximum insolation is 0.78 to 1 which is about the



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Double Sun, continued...

same as the previous system. No doubt adjustments could be made to the initial conditions that would cause the suns to maintain a constant distance from each other and hence, keep the insolation even more nearly constant.

System 3. An unstable orbit. Here we have one of the many possible unstable situations. Sun 2 is again twice the mass of sun 1 and they dance around each other now approaching and receding. This, however, is not what makes the orbit of the planet unstable. The problem is that the planet starts out with too small a velocity. It spirals down until it closely approaches one of the suns where a "gravity whip" causes it to gain speed and be thrown out of the system. This gravity whip has been used in flybys of Jupiter to accelerate and redirect some of the Pioneer spacecraft on their way to Saturn.

I'm still exploring solar systems. It's as much fun as reading about them. As a matter of fact, maybe one might serve as a good background for a story of my own:

"John stood on the beach watching the blue sun set behind the waves. The red companion glared down from high in the sky. It was the beginning of the little summer when the planet approached the bright blue star most closely; and already it was hot and humid. John heard a noise behind him and turned..." □

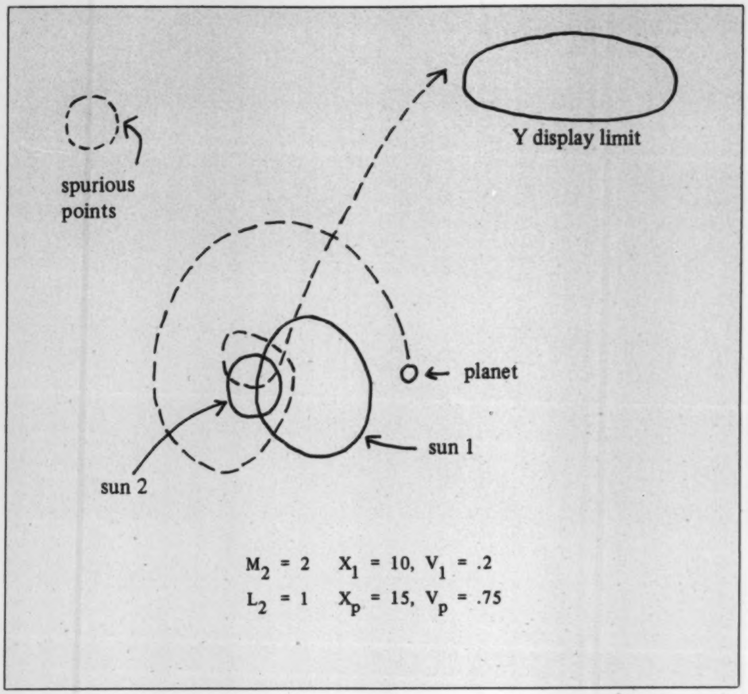
spurious points
Y display limit
planet
sun 1
sun 2
$M_2 = 2 \quad X_1 = 10,\ V_1 = .2$
$L_2 = 1 \quad X_p = 15,\ V_p = .75$

Figure 10. An unstable orbit.

```
 5 TS=0:BS=1000
 10 REM TWO SUNS ONE PLANET
 20 PRINT "INPUT DATA ON SUN 2"
 30 PRINT "MASS=";
 40 INPUT M2
 50 PRINT "LUMINOSITY=";
 60 INPUT L2
 70 PRINT"INITIAL X OF SUN 1=";
 80 INPUT X(1)
 90 X(2)=-X(1)/M2
 100 PRINT "INITIAL VY OF SUN 1=";
 110 INPUT VY(1)
 120 VY(2)=-VY(1)/M2
 130 PRINT "INITIAL X OF PLANET=";
 140 INPUT X(3)
 150 PRINT "INITIAL VY OF PLANET=";
 160 INPUT VY(3)
 170 DT=1
 180 PRINT"♥"
 190 REM RA IS THE DISTANCE BETWEEN THE SUNS
 200 RA=((X(1)-X(2))↑2+(Y(1)-Y(2))↑2)↑.5
 210 REM RB IS THE DISTANCE FROM PLANET TO SUN 1
 220 RB=((X(1)-X(3))↑2+(Y(1)-Y(3))↑2)↑.5
 230 REM RC IS THE DISTANCE FROM PLANET TO SUN 2
 240 RC=((X(2)-X(3))↑2+(Y(2)-Y(3))↑2)↑.5
 250 REM AX IS ACCELERATION IN THE X DIRECTION
 260 AX(1)=M2*(X(2)-X(1))/RA↑3
 270 AX(2)=-AX(1)/M2
 280 AX(3)=(X(1)-X(3))/RB↑3+M2*(X(2)-X(3))/RC↑3
 290 REM AY IS ACCELERATION IN Y DIRECTION
 300 AY(1)=M2*(Y(2)-Y(1))/RA↑3
 310 AY(2)=-AY(1)/M2
 320 AY(3)=(Y(1)-Y(3))/RB↑3+M2*(Y(2)-Y(3))/RC↑3
 330 FOR I= 1TO 3
 340 VX(I)=VX(I)+DT*AX(I)
 350 VY(I)=VY(I)+DT*AY(I)
 360 X(I)=X(I)+DT*VX(I)
 370 Y(I)=Y(I)+DT*VY(I)
 380 PX=X(I)
 390 PY=Y(I)
 400 GOSUB 9000
 410 NEXT I
 420 REM CALCULATE HEADING INFORMATION
 430 T=T+1
 440 IF Y(1)<0 THEN F1=1
 450 IF Y(1)>0 AND F1=1 THEN M=M+1:F1=0
 460 IF Y(3)<0 THEN F2=1
 470 IF Y(3)>0 AND F2=1 THEN Y=Y+1:F2=0
 480 PRINT"▒"
 490 PRINT"YEAR=";Y,"SUNTH=";M
 500 PRINT "TIME=";T
 510 IS=1/RB↑2+L2/RC↑2
 520 PRINT "SHINE=";100*IS
 530 IFIS>TS THEN TS=IS
 540 IF IS <BS THEN BS=IS
 550 PRINTTS;BS
 560 GOTO 190
9000 REM PLOT THE POINT PX,PY
9010 TX=INT(PX/2)
9020 TY=INT(PY/2)
9030 DX=INT(PX-2*TX)
9040 DY=INT(PY-2*TY)
9050 D=2*DX+DY
9060 DS(0)=123:DS(1)=126:DS(2)=108:DS(3)=124
9070 IF TX>20 THEN TX=20
9080 IF TX<-20 THEN TX=-20
9090 IF TY>12 THEN TY=12
9100 IF TY <-12 THEN TY=-12
9110 REM SHIFT CENTER
9120 TX=TX+20
9130 TY=13-TY
9140 REM CALCULATE POSITION ON SCREEN
9150 L=40*TY+TX+32768
9160 POKE L,DS(D)
9170 RETURN
READY.
```

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CIRCLE 135 ON READER SERVICE CARD

Lee Felsenstein: Renaissance Man

Creative Computing talks to the designer of the Sol-20, Expander and Osborne 1.

David H. Ahl

Some months ago I had the opportunity to chat with Lee Felsenstein about a broad range of topics. Lee grew up in Philadelphia but went west to UC Berkeley in the early 60's. He was involved in more than a fair share of "protest" activities including, significantly, the free speech movement.

I first met Lee when he more-or-less was the engineer packed with the first Sol-20 delivered to Creative Computing. At that time he still dressed in Army fatigues left over from hippie days.

Today Lee is rarely seen in public in other than a pinstriped three-piece suit. Yet his thoughful views of technology and people remain strongly shaped by the idealistic 60's.

Not incidentally, Lee is the designer of three significant computers: the Sol-20; its successor, the Expander; and the Osborne I.

L.F.: The Osborne I. You probably can tell from that there's an implication for an Osborne 2 and an Osborne 3 in the works somewhere.

D.A.: In your mind or otherwise?

L.F.: Well, it exists in my mind *and* otherwise. I am not prepared to discuss what is going to be in these particular machines. As you might expect they are going to involve enhancement of certain aspects of the basic unit.

D.A.: Didn't you also have a major role in designing The Expander, the so-called Swedish Sol? What about that?

L.F.: A delightful machine! It's one that people can get their "greasy" little fingers into and make it do lovely things of which I never thought. That was the whole point behind much of my computer work. The Expander is an S100 machine, although it is really the extension of a Sol. It's the next Sol that would have been. It's a Z80 machine with color. It has interrupts to relieve the programmer of onerous burdens. In it the original Sol personality module grew into an NE50 Bus, which is for a little piggy-back card (or stack of cards) that fits inside.

The S100 memory boards also use a neat piggy back arrangement for putting more than 16K of memory in just one slot. Of course, you can fit more dynamic memory than static memory on the same size board. This is fine unless you're a static memory fanatic like I am. The original Swedish Sol (ahem, Expander) which exists in four painstakingly-wired prototypes has 8K of static RAM on it and a provision for adding a piggy-back board with 8K more. I put in the static RAM but had to fight some opposition to it. I feel that in an S100 environment, dynamic memory is asking for trouble. With it you cannot always control the environment of what a user puts on the bus.

The Osborne machine is my first foray into dynamic memory. Please note that I have survived. I'm a bit surprised.

In working with dynamic memory, one has to realize, as I hope I never forget, that all digital design is actually analog design. There is no such thing as cleanly switching from one state to another except for tunnel diodes and I don't believe they exist. You go through states and levels and you follow certain profiles and curves but you will jiggle and bounce and undershoot and overshoot which all matters. One has to be at least a passable analog designer in order to be a good enough digital designer. I have seen several designs that have foundered on the rocks of the analog considerations.

D.A.: Not to change the subject, but what happened to the Community Memory Project? Some three or four years ago

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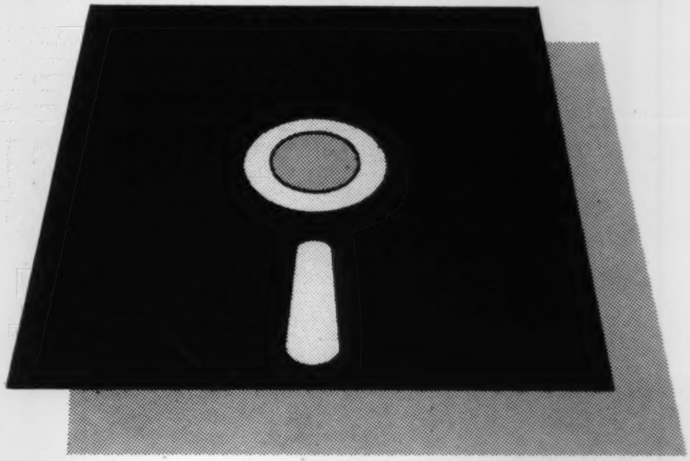

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you planned to use the Sol-20s as terminals to a PDP 11 as a node.

L.F.: Currently the group is showing off their relational data base system sequitor which is the core of the Community Memory System which has yet to come but may do so later this year. The participants in the project have always seen it as a long range project. The work that has been going on has been very unspectacular. Every year I have been asked, "where is it now?" and I say "Oh, we're still building it." The building blocks are mostly built, the Provost multi-CPU operating system is functioning. The file system is the one thing that is not fully formed. Provost is operating for the X25 network package and we are selling that. (We're not selling anything actually; we are licensing it.)

When asked about Community Memory, I always say "Oh, we're still building it."

So Community Memory Project has built three major building blocks: 1) a multi-CPU operating system—finished and available. 2) The sequitor relational data base system. This is basically a combination between a word processing system and a relational data base system—finished and being demonstrated. 3) A file system—work is in progress.

The system runs on an LSI-11, under RT-11. However, it's written in C so it can run on whatever machine has the compiler or co-generator. Incidentally, we are looking for a good 6502 co-generator for C. We know about the one from Vanderbilt University but it doesn't really meet the requirements.

D.A.: I understand you've also been involved with Bill Etra in the development of some new video systems. Can you enlarge on that?

L.F.: The Digital System for Etra is a modular system. (I seem to have a constitutional prohibition against designing anything not modular.) It can be reconfigured at several different levels. It could go down to a "hobbyist" grade digital video system. Unfortunately, even hobbyist grade digital video systems are not cheap at this time.

On the side, Bill Etra was trying to make a "Video Freaks Digital Video Processor." The problem was that he had no idea who was going to buy it or why. He thought that all of his video freak friends would immediately buy one as soon as they were available but that kind of hope is not sufficient to get a company going. That is not substitute for management no matter how much money you have, because no matter how much money you have you will run through it.

D.A.: Wasn't he financed by an Australian group initially?

L.F.: I wouldn't say financed; he got a contract to produce a 3-D video processor. With that money he then went and started something he called Video Modular Systems and, unfortunately, he is an impatient fellow and charged off in all directions at once and I, unfortunately, went with him. But the money didn't last. In the process, we got some designs done to the point of prototype. Engineering, such as it was, did their job. However, then came the problem of marketing and that's where it all blew up.

D.A.: What about the product?

L.F.: It's basically a big memory box and some interface electronics. Each box has eight 32K cards, that is 256K bytes. That's one field. A frame consists of two fields, odd and even. The US standard is 525 lines per frame which is made up of two interlaced fields, alternate lines, one field after the other. So we really store one field at a time and the next one is the next interlaced field. So to be very strict about it you need two of these boxes to store one frame. But if you do that and freeze the picture you find that there is a flicker between the two fields. Every alternate line is displaced a little bit if something has been moving. The solution to all of this has been simply to throw away that second field and replicate the first field so that every line says the same thing. That, of course, saves an entire memory box too.

D.A.: That's for black and white. For color, do you need three boxes?

L.F.: Yes, red, green and blue. There may be other ways of splitting up the picture also.

Bear in mind, in this form, these memory boxes are not for video freaks, they're for video engineers and people who have video studios and transmitters. A system like this should have six boxes to store a full-color frame consisting of two fields and provide the ability to manipulate the picture. That's $60,000 for starters. Then you need more boxes to switch the video, manipulate the picture, etc. And you need a computer to run it, an LSI-11. Each box has a computer interface card in it and a ribbon cable.

Bill Etra had a minor crisis when he found out that I had ordered an LSI-11 just to run his box. He thought I was going to take a piece of perf board, put a few sockets on it and do my magic thing and we would have a controller for it. But what he found was that he bought a very good computer with the money he may or may not have had. It's a big professional studio-quality system. The kind of things

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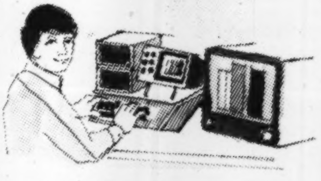

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that can be done with it involve a large number of special effects. Right now the industry builds video boxes for particular special effects. In contrast, this one has a degree of generality in it that makes it kind of interesting. It is going to be a very good play tool. We are already running it with the postage stamp effect which puts a reduced moving picture inside of a frozen full-size picture.

D.A.: Can it produce some of the effects that NBC used on that famous football game that they broadcast without sound? You recall, it was at the end of the 1980 season between two teams that had no possibility of getting into any championships. The entire game was broadcast using only video special effects as the commentary. They had closeups of referee signals, split images with four and five images at one time, frozen images with moving overlaps, etc.

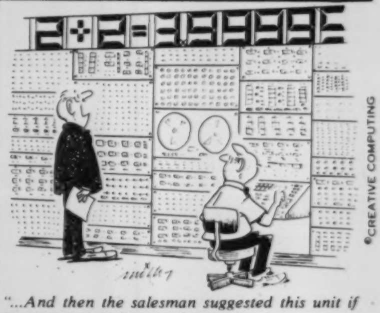
L.F.: That's the kind of thing this memory box can do. The box can be reconfigured instantaneously through the computer. That's the trick; it's not hard wired. You can do things such as frozen animation by distributing little reduced pictures across the screen in any relationship. Not necessarily an X-Y relationship, starting from upper left to lower right, but you can spot these pictures around the screen and keep running around and changing them, grabbing a frame each time and putting it anywhere.

D.A.: Lee, you seem to be involved in scores of fascinating projects. What are you most enthusiastic about?

Even hobbyist grade digital video systems are not cheap. After all, to store one video frame requires 256K of memory.

L.F.: I am enthusiastic about community memory and its relation to people. In it people will use technology in ways that might be called altruistic but are actually very self-interested from the standpoint of society as a whole. I am not interested in technologies as toys. The toy theory of history says that men grow up playing with toys and, as a result, continue to do so on a larger scale and fight wars, make pollution, etc. Why not be honest and just make toys? The personal computer seems to be one of the best toys around and it would seem to be valuable functioning in this society to serve just as that.

But I call the Community Memory Project a project to allow the world to take itself over through the manipulation of toys, or by creating particular toys that would otherwise have no reason to exist. That's what I find interesting: the bestowing of technology under circumstances and in forms which allow people to broaden their collective horizons. ☐



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Professional musicians will still want to use the original Apple Music Synthesizer (AMS) for its extended range and volume controls (the AMS has a range of 8 octaves). But for the Apple owner who is interested in music as a hobby, the AM-II is the best music peripheral value available today.

Requires: 16K Apple II or Apple II Plus, cassette or Disk II, and an external audio amplifier (all necessary patch cords are included).

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Seeing-Eye Computers

Ruth-Carol Cushman

> Creative Computing *is published in Morristown, NJ, the home of the original Seeing Eye dog. Now, from Cambridge, MA, we learn about a Seeing Eye Computer that enables the blind to read printed material.* —*EBS*

"It's the most wonderful thing in the world—I can't describe the joy of putting a piece of paper on the machine and hearing what is there—" The speaker is Linda Skroski, a music graduate from the University of Colorado who has been blind since birth. Linda can do almost anything. She skis, she sings, she travels abroad, she runs an office. And now, for the first time, she can read a book without using Braille, without asking someone else to read it to her, and without waiting for a pre-recorded tape.

Homer Page, head of the program for disabled students at the University of Colorado, is also blind. He ran for the state legislature in 1980 in spite of what some people might consider a handicap. During the campaign he read "hundreds of things, from letters to summaries of legislative documents."

Around the country are computer users who cannot see the video screen or the computer printouts. But they are just as efficient as their sighted counterparts.

The Kurzweil Reading Machine is the miracle that makes all this possible. Physicist Mike Hingson, also blind, travels around the country for the National Federation of the Blind demonstrating the machine and teaching people how to use it. "It's the greatest thing since Braille," he says.

Designed by Ray Kurzweil, an engineering graduate from M.I.T. who started programming computers when he was twelve, the machine uses an electronic scanner with a speech synthesizer to read printed material aloud. It is programmed for one thousand linguistic rules plus two thousand exceptions and can read 200 different type faces at up to 250 words per minute. A new era of independence has opened for the blind who can now read—on their own—a wide variety of materials: books, magazines, newspapers, business memos, personal typed correspondence, and computer output.

Out of about 40,000 books published each year, only about 350 are available in Braille. Those that are available are expensive and time-consuming to produce and bulky to store. For instance, Leon Uris' *Exodus* cost $93.20 to transcribe into Braille and requires three feet of shelf space to store.

A blind professional may spend up to $200 a week for an assistant to read printed material aloud. With the advent of the Kurzweil, the blind can now read anything they wish at any time they wish. And they can do so in privacy. As one user pointed out, "It's sort of embarrasing to ask someone you don't know to read a risque novel out loud!"

Even children as young as first graders learn to use the machine quickly and love it. At the Beethoven School for the Blind in Boston the children (age 6 through 12) nicknamed the machine "Kurzie" and regard it as almost human. One happy child summed it up: "What it does, it takes a picture and comes out in a voice. It's like a radio—you're like the radio announcer—you decide what you want to hear."

Originally this voice had a "heavy, foreign accent," but a newly developed synthesizer has a deep resonant "baritone" voice that produces a more natural sound. Like most standard synthesizers the Kurzweil reproduces the sixty or so phonemes (basic units of sound) that make up English speech. But in addition, the Kurzweil device has a system that analyzes the syntax of each sentence. It duplicates nuances in pronunciation by differentiating sounds according to their relationship to preceding and following sounds and silences.

"Sometimes you feel as though there's really a tiny, little person sitting inside the box, and maybe you should invite him out for coffee," says Nancy Cateora, a volunteer who works with the machine at the University of Colorado Libraries.

Nancy sees the Kurzweil as one way of helping end prejudice against the blind. Although few people would admit to such prejudice, there is no doubt that it is harder for a blind person to get a job than it is for the sighted. "This machine should bring about a lessening of preconceived notions of what the blind are capable of doing," says Nancy. "In the four years I have worked with the blind, I have found their limitations are ones *I* set for them. It's *My* hangup, not theirs . . . . These

---

Ruth-Carol Cushman, 1401 Mariposa Ave., Boulder, CO 80302.

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The terrain is dangerous and difficult; the enemy forces are powerful and varied. (You may not see the enemy even when you are in the same general area...but, on the other hand, the enemy may not see you either.) There is always the chance of an attack by an invisible enemy.

There are two scenarios and five levels of difficulty...level five is almost impossible to win. There are usually no fixed playing times for Scenario 2; you play until you get the governor and escape or until you are killed. But you can even set a fixed playing time in Scenario 1.

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A partial list of Wizardry features includes—A 10 level maze—8 character classes—5 races—20 stored on disk—3D maze display—complete castle—hundreds of monsters and magic items—monsters appear in mixed groups—50 castable spells, usuable by players, magic items and even monsters—44 page illustrated manual and much, much more all for $49.95 (N.Y. residents add sales tax).

But don't take our word for it, *Wizardry* received reviews in the May issue of *Creative Computing*, the April issue of *Popular Mechanics*, page 38, and the August issue of *Softalk* magazine.

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CIRCLE 332 ON READER SERVICE CARD

A teenager reads her text book with the help of the Kurzweil Reading Machine at the Special Education Room, Kennedy School, Medford, MA.

Linda Skroski, shown with her seeing-eye dog, is enthusiastic about the number of blind people who are now able to read for the first time on their own.

minds shouldn't be wasted by being shunted into niches *We* think are appropriate."

The U.S. Office of Civil Rights would agree with Nancy. They have purchased ten machines for their headquarters, their regional office, and for the Office of Civil Rights Training in Denver. This is the largest order placed by a single organization for the internal use of its staff.

By mid-1980 more than 200 reading machines had been placed in schools, libraries, rehabilitation centers, and offices in the U.S., Canada, England, and Australia. In New York the machines are considered so vital the legislature provided $550,000 to purchase and install them in each of the twenty-two public library systems. "The KRM opens up a whole new world of reading services for the blind and physically handicapped," stated the New York Library Association in support of the legislation.

Eventually many blind people will be able to own their own Kurzweil. However, at present the cost is almost prohibitive. Musician and composer Stevie Wonder was the first person to acquire his own Kurzweil which he uses to read about computers and music as well as for recreational reading. (One of the first books he read was *The Secret Life of Plants* after recording a popular album by the same name.)

The Kurzweil Reading Machine was actually field tested by blind users through the National Federation of the Blind. This testing resulted in many improvements to early models. For example, Kurzweil modified the machine to read photocopies, to handle italics and columns, to scan a page, and to respond to many additional user commands. A new compressed speech feature enables the blind to read print at a rate fifty percent faster than normal human speech. As improvements continue to be made, older models are quickly updated by insertion of a re-programmed cassette so it is not necessary to purchase a new machine to benefit from new developments.

To operate the machine, a user places the material on a glass surface, and then commands the machine to perform certain tasks by striking control keys on a small computer terminal. Under the glass a camera moves back and forth across the page; it can be stopped at any time by the user and commanded to spell a word, give punctuation, or back up and repeat. The user can also speed up or slow down the voice and adjust its tone.

The original 1974 prototype, which could read only print typed on Ray Kurzweil's personal typewriter, occupied half a room and cost a fortune to build. Three years ago the KRM had been reduced to the size of a photocopier and was priced at $50,000. Although this model seems a miracle to those who use it, Ray Kurzweil was not satisfied. New models weigh only about 90 pounds and are priced at $29,500.

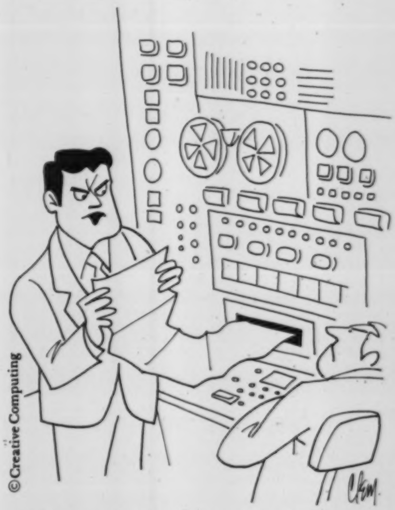
Still not satisfied, the Kurzweil people recently gave a voice not only to the printed word—but also to computer output. Called "Speech Output System" or "SOS," this new device stores the output from the external computer in the KRM memory and then produces the spoken word. All of the controls available on the conventional KRM are also available on SOS so the user can command the machine to "spell," "repeat," "locate," etc.

At the touch of a button the user can hear what is normally displayed on video terminals or on print-outs. The KRM 3 is compatible with any computer which outputs industry standard ASCII communications code, according to Kurzweil's latest new release.

Other new spin-offs from the original KRM include the Kurzweil Talking Terminal, which will enable voice impaired people to communicate orally when it is attached to any terminal, and a print-to-Braille machine, which will convert a 500-page book to Braille in three days instead of the usual three to six months now required. The corporation is still working on improvement and hopes to reduce the machine to the size of a brief case at a cost of no more than an automobile.

Blind user Gayle Powell looks forward to the day when blind people can buy their own Kurzweil: "When we can read our own office memos, instructional materials, and letters," he says, "we can become truly independent and can end job discrimination against the blind."

For further information, write to: Kurzweil Computer Products, Inc., 33 Cambridge Parkway, Cambridge, MA 02142 or phone (617) 864-4700. ☐



"Well George, I'd say, 'no, no, no, a thousand times, no,' seems pretty definite."

Towering Inferno

Tim Basham

While flames flicker thirty stories above, you and your crew of brave firefighters must try and save the people who leap from the inferno. Once a person has been caught, he must be taken to the ambulance, but hurry—another jumper is on his way down. If you save ten people before losing five, you win.

```
5 CLEAR100
10 CLS:PRINTTAB(20)"TOWERING INFERNO!":PRINT:PRINT"A BUILDING IS ON FIRE AND YOU
R JOB IS TO CATCH PEOPLE IN YOUR":PRINT"NET BEFORE THEY HIT THE GROUND.":PRINT"Y
OU MUST CATCH 10 BEFORE 5 DIE.":PRINT"ONCE YOU CATCH ONE THROW HIM IN THE AMBULA
NCE."
15 PRINT:PRINT"CONTROLS ARE:   < - LEFT":PRINTTAB(16)"> - RIGHT.":PRINT:PRINT"GO
OD LUCK!":PRINT"PRESS <ENTER> TO BEGIN."
20 IFINKEY$=""THEN20
30 '
31 '  * GRAPHICS *
32 '
100 A$=STRING$(8,191):B$=CHR$(176):C$=CHR$(163)+CHR$(143)+CHR$(147):D$=CHR$(156)
+"      "+CHR$(172):E$=CHR$(183)+CHR$(131)+CHR$(131)+CHR$(131)+CHR$(131)+CHR$(1
31)+CHR$(131)+CHR$(131)+CHR$(187)
110 F$=CHR$(152)+CHR$(152):G$=CHR$(185)+CHR$(167):H$=CHR$(131)+CHR$(131)+CHR$(14
3)+CHR$(191)+CHR$(191)+CHR$(143)+CHR$(131)+CHR$(131)
115 J1$=STRING$(7,32):Z$=STRING$(5,143)
130 V$=CHR$(156)+CHR$(152)+CHR$(180)+CHR$(176)+CHR$(176)+"    "+CHR$(172):X$=CHR$
(183)+"    "+CHR$(130)+CHR$(131)+CHR$(131)+CHR$(131)+CHR$(187)
150 CLS:FORN=128TO960STEP64:PRINT@N,A$;:NEXT:PRINT@887,A$;:PRINT@951,A$;:PRINT@1
015,H$;
160 PRINT@890,CHR$(143);CHR$(131);CHR$(143);:PRINT@955,CHR$(188);:X=936
170 PRINT@15,"---( HELP! )";:FORN=1TO300:NEXT:PRINT@15,J1$;J1$;
200 R=0:U1=0:IFO=10ORP=5THEN4000ELSEPRINT@50,"SAVED -";O;:PRINT@114,"LOST  -";P;
:Z=RND(21)+12
205 IFZ1=0THEN208
206 FORT=1TORND(10):GOSUB3000:IFZ1<>0THENNEXTT:GOTO210
207 GOTO210
208 FORT=1TORND(10):GOSUB2000:NEXTT
210 GOSUB10000
240 IFR+64=X+5ORR+64=X+6ORR+64=X+4THENPRINT@R,"  ";:Z1=1:O=O+1:GOTO200
270 GOTO210
1000 '
1001 '  * MOVEMENT *
1002 '
2000 IFPEEK(14580)=16THENX=X-2
2002 PRINT@RND(8)+63,CHR$(RND(47)+144);
2010 IFPEEK(14580)=64THENX=X+2
2015 IFX<906THENX=906
2016 IFX>937THENX=937
2020 PRINT@X,;"  ";D$;"  ";:PRINT@X+64,"  ";E$;"  ";
2030 RETURN
3000 GOSUB2000:PRINT@X+68,Z$;:IFX=937THENGOSUB5000
3010 RETURN
3997 '
3998 ' * WIN OR LOSE *
3999 '
4000 W$= "OH! TO BAD! YOU ARE A BIG LOSER!":S$="WELL,
WHAT DO YOU KNOW! YOU SAVED 10 PEOPLE!"
4005 PRINT@207," ";
4010 IFO=10THEN4600
4500 FORN=1TOLEN(W$):PRINTMID$(W$,N,1);:NEXT:GOTO4700
4600 FORN=1TOLEN(S$):PRINTMID$(S$,N,1);:NEXT
4700 PRINT@272,"PLAY AGAIN?";:INPUTQ1$:IFQ1$="YES"
THEN5ELSEEND
4800 '
4801 ' * HEAVE HO! *
4802 '
5000 PRINT@X+2,V$;:PRINT@X+66,X$;
5010 FORY=815TO822STEP2:PRINT@Y+1,"  ";F$;:PRINT@Y+64,"
";G$;
5015 Z1=0:X=936
5020 GOSUB10000:NEXTY
5050 PRINT@949," ";:PRINT@823,"   ";:Z1=0:PRINT@887,
CHR$(191)+CHR$(191);:RETURN
5810 RETURN
5901 '
5902 ' * AAAAAAHHHHHHH! *
5903 '
10000 PRINT@R,J1$;:PRINT@R+64,J1$;:IFR>832THEN10500
10002 PRINT@RND(8)+63,CHR$(RND(47)+144);
10005 IFU1=1THEN10060
10010 IFR>Z-1THENR=Z:U1=1
10020 R=R+3:PRINT@R+1,B$;:PRINT@R+64,C$;
10030 IFZ1=1THENGOSUB3000:GOTO10050
10040 GOSUB2000
10050 RETURN
10060 R=R+64
10065 PRINT@R+1,B$;:PRINT@R+64,C$;
10070 IFZ1=1THENGOSUB3000:GOTO10090
10080 GOSUB2000
10090 RETURN
10401 '
10402 '   * OAF! *
10403 '
10500 PRINT@Z+897,F$;:PRINT@Z+962,G$;:P=P+1:GOTO200
```

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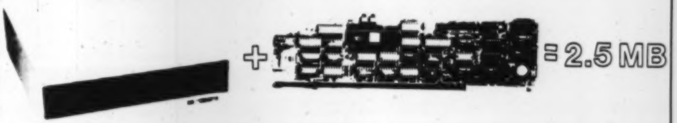

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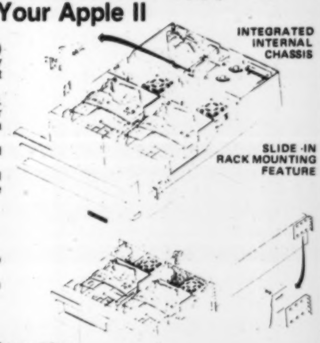

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CIRCLE 146 ON READER SERVICE CARD

To: David Henderson and Creative Computing From: Readers Re: The Small Computer Industry

David Henderson's "open letter" to the small computer industry in the May 1981 issue of Creative Computing *inspired a flood of letters from readers. The opinions printed here are representative of the many different views expressed in those letters.*

In addition two people wrote to offer solutions to the Apple/Centronics compatibility problem. Gil Taylor of Vancouver, WA, recommends a text processing program called T.O.U.G.H. from Nibble, Box 325, Lincoln, MA 01773. $24.

Jim Osborn wrote his own text formatter which he plans to market under the Micro-Media name. His address is P.O. Box 453, Arlington Heights, IL 60004.—EBS

...the Japanese Will

Gary Martin

So Apple and *Creative Computing* say the unfortunate Mr. Henderson is at fault (May 1981). "He should learn a little about the product he buys" and ". . .let him also be informed." Horse hockey!

Mr. Henderson and the millions of computing neophytes like him don't want to be "informed." Mr. Henderson isn't "informed" about his copying machine, typewriter or telephone. He just uses them, knowing little and caring less about how they work.

What he wants from the micro industry is a cheap black box with an "on" button that will do word processing and a mailing list. There is nothing technically impossible here nor is the demand for a turnkey "appliance" unreasonable. Yet what *Creative*, Apple, CCA and others in the industry respond with is "It's a jungle out there and if you get bitten, we're not responsible."

Mr. Henderson's problem is not new, yet the industry has seen fit to ignore it and blame the victim. Under our economic system, if the present pillars of microdom won't satisfy the Hendersons, other such as Lanier, IBM and the Japanese will.

And as Tandy, Apple, Commodore et al find themselves eclipsed by those who know that the essence of this business is really customer support, not the latest whiz-bang hardware innovation, I wonder whom they will blame then.—Gary Martin, 1415 W. Casino #111, Everett, WA 98204.

The Dealer's Point of View

E. Craig Martin

As a computer store owner I feel obliged to respond to the recent article by David Henderson. His problem is more universal than any of us realize, and I wholeheartedly sympathize with his plight. It is surprising that he was able to inject humorous notes into his very serious situation, for if I found myself in his shoes, it would be difficult to be droll.

When I am out of town on business, I make a practice of visiting local computer stores to learn new merchandising techniques, store layouts, and gather any other information that can be used to improve my own operation.

The knowledge (or lack of it) demonstrated by some computer store personnel is nothing short of shocking. I could use reams of paper telling stories about the unprofessionalism and lack of product knowledge encountered. Most of these stories would be strikingly similar to Mr. Henderson's experiences.

In many cases it is quite obvious that some computer stores assume that they are selling something as common as a vacuum cleaner, and that the customer should not bother them requesting information that is contained (somewhere) within their manuals.

This is a very dangerous practice because it creates customers who either underutilize their computers or put them in the closet as a bad investment. The resulting bad publicity as these unhappy customers tell their friends is bad for the entire microcomputing industry.

I, for one, would be pleased to see some sort of industry certification process to separate the peddlers from the professionals, and the manufacturers should demand a minimum level of competency before franchising a store to carry their products.

Another danger that we face is the proliferation of mail order discount houses. Advertisements have over-sold the consumer on the ease of operation and the amount of training necessary to use fully the power inherent in today's microcomputer. Therefore the consumer is misled into saving a few dollars and purchasing mail order. These customers invariably return to my store after United Parcel Service "installs" their computer, displaying rage, tears, or embarrassment. I refrain (with some difficulty) from saying, "I told you so!"

These people just didn't realize that included in our price is the knowledge, service, advice and handholding that are the value-added items that my customers receive as part of our standard business policy. All a mail order house needs is a couple of minimum wage high school dropouts who can paste on UPS labels. Our employees are professionals, and are paid a professional wage and we are proud of them!

We encourage any customer to try any software before purchase, and we offer training in the use of the program. This training is free on our premises, or we will provide training at a nominal charge on the customer's premises.

In the event of defective software media after purchase, I make an immediate replacement. After all, why should *my* customer have to hasssle with the manufacturer to get a replacement diskette? That is my responsibility, not his!

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LABYRINTH - 8K - This has a display background similar to MINOS as the action takes place in a realistic maze seen from ground level. This is, however, a real time monster hunt as you track down and shoot mobile monsters on foot. Checking out and testing this one was the most fun I've had in years! — $13.95. OSI

THE AARDVARK JOURNAL

FOR OSI USERS — This is a bi-monthly tutorial journal running only articles about OSI systems. Every issue contains programs customized for OSI, tutorials on how to use and modify the system, and reviews of OSI related products. In the last two years we have run articles like these!

1) A tutorial on Machine Code for BASIC programmers.

2) Complete listings of two word processors for BASIC IN ROM machines.

3) Moving the Directory off track 12.

4) Listings for 20 game programs for the OSI.

5) How to write high speed BASIC — and lots more —

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For OSI, TRS-80, and COLOR-80. These Adventures are written in BASIC, are full featured, fast action, full plotted adventures that take 30-50 hours to play. (Adventures are interactive fantasies. It's like reading a book except that you are the main character as you give the computer commands like "Look in the Coffin" and "Light the torch".)

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This ADVENTURE takes place on the RED PLANT. You'll have to explore a Martian city and deal with possibly hostile aliens to survive this one. A good first adventure.

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This one takes place aboard a familiar starship. The crew has left for good reasons - but they forgot to take you, and now you are in deep trouble.

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OSI NEW-NEW-NEW OSI
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The easy way to speed in your programs. The tiny compiler lets you write and debug your program in Basic and then automatically compiles a Machine Code version that runs from 50-150 times faster. The tiny compiler generates relocatable, native, transportable machine code that can be run on any 6502 system.

It does have some limitations. It is memory hungry — 8K is the minimum sized system that can run the Compiler. It also handles only a limited subset of Basic — about 20 keywords including FOR, NEXT, IF THEN, GOSUB, GOTO, RETURN, END, STOP, USR(X), PEEK, POKE, -, =, *, /, , <,> , Variable names A-Z, and Integer Numbers from 0-64K.

TINY COMPILER is written in Basic. It can be modified and augmented by the user. It comes with a 20 page manual.

TINY COMPILER — $19.95 on tape or disk OSI

SUPERDISK II

This disk contains a new BEXEC* that boots up with a numbered directory and which allows creation, deletion and renaming of files without calling other programs. It also contains a slight modification to BASIC to allow 14 character file names.

The disk contains a disk manager that contains a disk packer, a hex/dec calculator and several other utilities.

It also has a full screen editor (in machine code on C2P/C4)) that makes corrections a snap. We'll also toss in renumbering and program search programs — and sell the whole thing for —

SUPERDISK II $29.95 (5¼") OSI

BARE BOARDS FOR OSI C1P

MEMORY BOARDS!!! — for the C1P — and they contain parallel ports!

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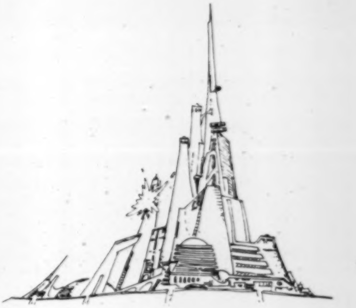

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This is a line-oriented word processor designed for the office that doesn't want to send every new girl out for training in how to type a letter.

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MAXI-PROS has both global and line edit capability and the polled keyboard versions contain a corrected keyboard routine that make the OSI keyboard decode as a standard typewriter keyboard.

MAXI-PROS also has sophisticated file capabilities. It can access a file for names and addresses, stop for inputs, and print form letters. It has file merging capabilities so that it can store and combine paragraphs and pages in any order.

Best of all, it is in BASIC (0S65D 51/4" or 8" disk) so that it can be easily adapted to any printer or printing job and so that it can be sold for a measly price.

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My company has been in business for over ten years, having added microcomputers to our other electronics lines four years ago. Two years ago it became obvious that computers were the direction to go, so I changed the name of the company to reflect the direction of our business. During the ten year history of my company I have always followed the same general business philosophy—a dollar's *worth* for a dollar *spent*.

Unless this philosophy becomes more prevalent within the industry the peddlers will leave such a bad taste in the mouth of the consumer that our industry will cease to exist. I have seen many computer stores go out of business, most of whom used "peddler" sales tactics with little or no product knowledge or customer support. With ten years behind me, I must be doing something right.

It is imperative that we become knowledgeable, service oriented professionals, and rid our ranks of the peddlers if we are to enjoy a long and prosperous future.

Mr. Henderson's advice, "let the buyer beware," is most appropriate, unless this industry undergoes a rapid maturation. For our own sake, let us hope it happens soon. Remember, our customers are the most important people in the world. Let's give them the service they are entitled to.—E. Craig Martin, President, Illinois Computer Mart, Inc., Route 8, Sweet's Corner Plaza, Carbondale, IL 62901.

Hire a Consultant

Richard Auerbach

I have read with interest the open letter from Mr. Henderson and the response by Mr. Roybal of Apple Computer. As the President of Cornell Micro Systems, I feel that I must take exception to both the letter and the response.

Mr. Henderson has a legitimate complaint, and Mr. Roybal's response boils down to "buyer beware." But, there is an answer. Mr. Henderson had the answer but refused to listen to the advice he received—find a computer programmer. Mr. Henderson found that too "expensive."

I have been advocating for over four years the philosophy that has made my company grow.

I have been advocating for over four years the philosophy that has made my company grow. We are not bringing anything into the market place, but the tried and true method of approaching a computer involvement. This is the area that I feel that Mr. Roybal is not answering the comment by Mr. Henderson. We feel that the correct approach to getting *involved* with a computer be it a \$1,000 machine or a \$20,000 machine is as follows:

First, a feasibility study. This should be an objective evaluation of the business needs and requirements. The study should show how the programs are going to work, i.e., screen displays and sample reports.

Second, what hardware is best suited for that project, and the recommendation should take into consideration the growth capability of the hardware as well as the business environment in which it will be used. It should also consider ease of maintenance and projected down-time. The recommendation should give the full price of the hardware and peripherals that are needed to run the software.

Third, how much the software will cost. How much is based on existing packages and to what degree they might have to be modified to meet the client's requirements, or if customization is required and that cost.

This report should be custom written for the client and the consultant/software house must be totally objective in its evaluation and recommendation. The firm preparing the study should *not* be in the hardware business nor be getting commissions from the hardware dealer or manufacturer. The study should become the property of the client so that if he desires, he can have competitive bids based on that study.

At this point, my company stops to give our client the time to decide whether to computerize or not. In some cases, the study has shown that the time/money savings are not sufficient to warrant any computer acquisition at all. If the cost is agreed upon, a contract is negotiated and signed, and a full sytem spec is developed and *must* be signed by the client before any coding is done. We tell our clients *not* to sign a spec until they fully understand everything in the document. Full documentation and training round out the entire package.

I realize that this method does seem to cost more, but what is Mr. Henderson's time worth? He bought products that did not work and equipment that was not compatible, and ended up with a bad taste about computers and the computer industry.

The Mr. Hendersons of the world will continue to take a beating until we in the industry—manufacturers, dealers, and software houses—work together to educate the small businessman and let him know that doing the job properly is in his own best interest. The old saying, "There is never enough time to do a job right, but always enough to do it again" holds very true in our field.—Richard Auerbach, President, Cornell Micro Systems, Inc., 93 Old Homestead Rd., Wayne, NJ 07470.

Do Your Homework

Larre Egbert

The open letter by David Henderson and the reply by Phil Roybal in the May 1981 issue struck a note with me. I recently decided to purchase a microcomputer.

The uses that I defined were as follows: scientific data processing, word processing, and computer assisted instruction. With this variety of applications I went through quite a quandary as to what computer to buy, what software to support it with, and what printer to buy.

Having had no experience with microcomputers whatsoever, I checked each of these points out very carefully. I checked with various dealers and found, as usual, very biased opinions. Biased toward what would profit them the most in some cases and in other cases just simple bias against use of a particular product.

I checked with people who owned computers, software or printers, I checked the magazine evaluations such as those found in *Creative Computing*. Lastly I tried out several of the better computers, software and printers.

Of course, all of this took time, but I am now a happy owner of a system that does all I wanted and much more. Of course, I have had problems, but I've worked them out, and I might add, with the help of the dealer and the manufacturers from whom I bought the system.

In all, I would say that the secret is to do the homework necessary to know what you, as a buyer, can expect.

What system did I buy? Well, let's just say that Phil Roybal would be happy with it.—Larre N. Egbert, Associate Professor of Biology, Utah State University, Logan, UT 84322.

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CIRCLE 158 ON READER SERVICE CARD

Magazines Can Help

Michael Lamb

After reading the open letter by Mr. Henderson and the reply by Mr. Roybal of Apple Inc., I was left with mixed feelings because I agree with both sides of the issue. Both viewpoints were equally valid, but as you had added, the problem can best be solved by thorough communication between parties.

The mini/micro computer age came upon us quickly and as with all new and novel products there were people who were out to "cash in" on the bonanza. Hence, some dealers were ripping off the public. These people have been weeded out thanks to the efforts of your magazine and others.

The problem facing the buyer today is to pick out from the many choices of computers and peripheral equipment (i.e. printers, monitors, circuit boards, software packages, etc.) that which will service his needs. Here the salesman plays the larger role in that he may be quick to sell, but slothful to reveal all the facts. If you don't ask, he normally won't bother to tell you the drawbacks or shortcomings of the systems which you may consider purchasing.

Not all salesmen are that way. For example, here in my community I only deal with one dealer, not because I get terrific buys, but solely because the salesman was the first to admit he didn't know how a particular software package operated and didn't proceed to "snow" me about it. Instead, we sat down and both tried out the package; thus, I knew full well all the pros and cons of what I was buying. This is how all purchases should be made. It leaves the buyer knowing what he has, and the salesman knowing what he sold.

The crux of the matter, then, as Mr. Henderson told it was that his "package deal" wasn't ideal. I think that there is some truth in that, because many dealers now are offering package deals to sell their computers. I am sure that the companies are aware of it, too.

> ***The salesman was the first to admit he didn't know how a particular software package operated.***

For example, I too, purchased a system similar to Mr. Henderson's and discovered that the printer (Centronics 737) has an interface card manufactured by the computer maker. The problem here is that is the Apple people go out of their way to interface another company's printer then they should do so to fully utilize *all* the printer's capabilities or not at all.

I realize that the problem is software oriented; however, if they make the interface, they should develop the software for the device. If the companies cannot do this then they should add a disclaimer to their product so the buyer will know what the product cannot do.

Too often now, even in your magazine, there are ads that tell how great products are and that they will interface to your computer; but fail to add that the functions that make their product so great are not fully supported by that interface. This I feel is a deliberate misleading of the buyer.

However, this still leaves it for the buyer to discover, and/or the salesman to inform the buyer. The only alternative we have left is to continue supporting magazines like yours which tell us about the products which we purchase. We can only hope that the companies will get the message and either inform us or develop the products we need (i.e. software or hardware packages that fully interface and support all functions of the peripheral device they interface) and thus increase the sales and popularity of their products.

If that cannot be done, then we should continue to use your magazine and tell others how to develop the necessary software or hardware to do the job.—Michael W. Lamb Sr., 6721A Saratoga Ave. NBU #3, Tucson, AZ 85708.

Support Your Local Retailer

James Wilson

In reference to the letter by David Henderson in your May, 1981 issue, I am glad to see that *Creative Computing* has the courage to print a letter on a subject with which I am in total agreement. I had some computer knowledge before purchasing my system. I spent quite a few hours working with the software to insure it was what I wanted, but in spite of this, I found many shortcomings after working with it for several months.

One of the most obvious errors which I as a non-accountant missed in the Accounts Payable program was the inability to enter a credit on the invoice side. The software company now claims that this is an enhancement for $75 rather than a correcting measure. Once again the small businessman is trying to stick it to another small businessman.

On the positive side, I also own an Apple II at home and have found all the software companies with the exception of Personal Software Company, very willing to re-copy my disks that have been locked from DOS 3.2 to DOS 3.3. I do not blame them for having their programs locked because of all the piracy in software going on today.

My salvation in my business system was my local retailer who corrected all the programs and really has kept me operating. My advice to everyone is to get a good local retailer and support him.—James W. Wilson, President, Glen Control Inc., Box 563, 400 N. Pierce St., Lansdale, PA 19446.

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2605

#1

CIRCLE 216 ON READER SERVICE CARD

There's Always a Quill Pen

Ed Jackson

In order for you to understand my reply, let me state that I have a 48K Apple with Programmer's Aid, resident Integer Basic, Applesoft card, disk drive Centronics electrostatic printer, Epson MX-80 printer, and an ALF music synthesizer.

In addition to about $1000 worth of games, I have many utility programs for graphics, music, data handling and text processing.

Now I want to tell you something, Mr. Businessman. I believe you would have a hard time in your business if you bought any of the equipment needed for your business by going into just one place and listening to one salesman. I don't think you would do it. You would know what you want, what was available, what it could do and what its limitations were before you spent the money. You wouldn't buy a pick-up truck if you were going to deliver heavy equipment. You wouldn't buy a two-burner hotplate if you were going to run a restaurant.

There are small business computers, (There is a comparison chart in the same issue of *Creative Computing* in which your letter appeared) which run from $3000 to $9450. There are printers which run into the thousands of dollars which give high speed letter quality printing. There are word processors costing two to five times as much as my Apple-Writer. There are other systems, other configurations, other languages. There are business oriented programs costing hundreds of dollars for each module. There are megabyte disk drives costing in the thousands of dollars. How could anyone intelligent enough to own his own business and survive be naive enough to just walk into a computer store, listen to a sales pitch and walk out with a sophisticated machine expecting miracles? One look at the ads in any computer magazine should have told you that you were buying, essentially a *home* computer, which *can* be expanded to do very amazing things applicable to business.

Mr. Henderson, have you ever thought just what an astounding thing you have? Good Lord, man! This is Buck Rogers stuff! You speak of "back to the old Smith Corona." If you can produce a page of error-free type in under a minute on the old Smith Corona, you are some kind of typist. How about adding a paragraph in the middle after you have completed the page, or changing the spelling of one often repeated work in the twinkling of an eye? Let me see you produce a ten-page document on the Smith Corona in ten minutes while you are out in the kitchen making a sandwich.

Certainly the Centronics is a dot matrix machine. Didn't you know that when you bought it? Didn't you look at type samples? Did you actually believe the little Centronics would do the same job as a Spinwriter, thimblewriter, daisywheel, ink-jet or IBM? For a tenth of the cost?

Let me see you produce a ten-page document on the Smith Corona in ten minutes while you are out in the kitchen making a sandwich.

Sure, your kid can play "Mary Had a Little Lamb" on the telephone! What the devil has that got to do with what a computer can do? I can produce complex music on my Apple just as I bought it, but with only one melodic line. With the purchase of an ALF board, I now have the ability to produce very complex music in three voices and play it through an external amplifier. It is beautiful and worth every penny!

I bet when you buy an automobile you know more about it than you knew about your Apple when you made that purchase. If you had never seen an automobile in your life, would you know how to make it work? Can you imagine the instructions necessary? All of us are "programmed" from birth to understand the complex tools of our highly technological society. Complicated instructions which came in manuals with earlier production models are not included anymore. I read a very early Ford manual which went into detail about inserting the ignition key, which way to turn it, where to place the gear shift, how to depress the clutch, the starter, move the gearshift, release the clutch, apply the brakes and so on. It was very funny to read, but I bet the first people who bought cars were darned glad the instructions were there. I bet they even read the manual. You know the old saying: when all else fails, read the instructions!

I don't own a business. I *do* own an Apple. And I am convinced that for a small business, (not G.M. or Sears) an Apple II, expanded with proper peripherals and software, can do the job.

My first computer was a TRS-80. It was stolen from my home and I replaced it with an Apple. Much as I love my Apple, I am sure if I still had my TRS-80, I would be very happy with it too. I now believe I would have bought the Apple first, except I had never even heard of it at the time. I saw a demonstration on TV some time later and looked for it when I had to replace the '80. But before I bought either machine, I bought the operating manual, and read it from start to finish. I also did this with the disk drive and the Applesoft card.

My final advice to you, sir, is to heed the *'caveat emptor'* advice with which you ended your letter. Why the devil didn't you think of that before you spent all that money? May I respectfully suggest if you have any further trouble that you turn the whole thing over to your 12-year old son? You can bet your socks *he* can make it work. He will be able to figure it out because if he was able to play "Mary Had a Little Lamb" without any instructions, or long distance phone calls, he has an open, inquisitive mind that explores possibilities. That's what computers are all about. The future! I think you *should* stick to your "Old Smith Corona" and if that fails you, there's always a quill pen.—Ed Jackson, 4100 Fairlane, Fort Worth, TX 76119.

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CIRCLE 343 ON READER SERVICE CARD

Microcomputer Applications in Clinical Medical Education:

Cardiac Arrest and Resuscitation

J. Michael Dean, M.D.

Physiological systems are complex; their behavior is often difficult for a student to understand. Recently, computer simulations have been used to teach students about various aspects of physiological function. However, I know of no computer programs for teaching physicians how to administer drugs during cardiac arrest and resuscitation.

In the hospital, particularly in the intensive care unit, cessation of a patient's heart beat (cardiac arrest) is a frequent occurrence, requiring immediate therapy. This therapy is often taught as the "A-B-C-D's":

A. Airway maintenance (removing food from mouth, etc.)

B. Breathing (artificial ventilation)

C. Circulation (external compression of chest)

D. Drug therapy (by physicians only)

Extensive training programs exist for teaching "CPR," or cardiopulmonary resuscitation. These programs teach mouth to mouth ventilation and external cardiac compression on mannequins. These manual activities are called "basic life support." Nearly anyone can be taught to do CPR, and CPR can be conducted outside medical facilities. Drug therapy is generally restricted to hospital settings, and is carried out by physicians or highly trained nurses.

Evaluation of experienced individuals such as physicians and nurses shows that CPR skills must be repeatedly reviewed and drilled in order to be effective. Even with regular practice, an actual cardiac arrest is an emotional and terrifying experience. The expression "computer overload" has been used to describe this situation in which stress overwhelms the expertise of the expert.

Medical students, interns, and residents are taught in the classroom about various drugs used in cardiac resuscitation. However, there are no effective methods for reviewing the use of this information under simulated conditions of cardiac resuscitation. Mannequins are used widely to practice the mechanics of CPR, but no one has yet devised a way to use them to teach drug administration. Thus, when the real event occurs, the physician must recall information which he learned in a quiet classroom and apply this in a stressful situation. If "standard" approaches are unsuccessful, the physician finds himself in an area of uncertainty. This added stress compounds the "computer overload"

```
IDENTIFY ALL COMMANDS BY
NUMBER OR LETTER.

Time: 3 minutes

Weight: 13 kg.

FINE VENTRICULAR FIBRILLATION

1. EPINEPHRINE 1:10000 (cc)
2. SODIUM BICARBONATE (meq)
3. ISUPREL (mcgms/min)
4. ATROPINE (mgms)
5. DOPAMINE (mcgms/min)
6. CALCIUM CHLORIDE 10% (cc)
7. BRETYLIUM (mgms)
8. CALCIUM GLUCONATE 10% (cc)
9. DEFIBRILLATION (watt-sec)
A. LIDOCAINE (mgms)
B. pH MEASUREMENT (requires 10-15 min)
C. CESSATION OF EFFORTS (final)
D. DOLBUTAMINE (mcgms/min)
E. PACEMAKER PLACEMENT (need 20 minutes)
```

Figure 1. Initial menu showing available commands and describing the patient being simulated.

```
2. "Hit 'cont' to enter the command." Cont.

"How many meq of sodium bicarbonate do you wish to give?"

26.

"This action required three minutes."

1. "Hit 'cont' to enter the command." Cont.

"How many cc's of epinephrine 1:10000 do you wish to give?"

3.

"This action required two minutes." (Rhythm changes to "coarse fibrillation")

9. "Hit 'cont' to enter the command." Cont.

"How many watt-seconds of energy to defibrillate?"

20.

"This action required two minutes." (Rhythm changes to normal rhythm.)

C. "Hit 'cont' to enter the command." Cont.
```

Figure 2. Typical sequence of commands to resuscitate patient. The rhythm changes automatically appear on the screen in place of previous rhythms. User inputs are underlined.

J. Michael Dean, M.D., Chief Resident's Office,
Children's Hospital of Los Angeles, P.O. Box 54700,
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CIRCLE 272 ON READER SERVICE CARD

```
CARDIAC ARREST SIMULATION EVALUATION REPORT.
THE INITIAL RHYTHM OF THE PATIENT WAS FINE VENTRICULAR FIBRILLATION.
THE INITIAL pH of the patient was 7.16
THE TIME PRIOR TO RESUSCITATION WAS 3 MINUTES
THE WEIGHT OF THE PATIENT IS 13 KILOGRAMS.
--------------------------------------------------------------------------------
Time in minutes..........................3
Rhythm treated...........................Fine ventricular fibrillation.
pH after treatment.......................7.35
Treatment chosen.........................Sodium bicarbonate (meq)
Dose chosen..............................26 TOTAL (which was 2.0 meq per kilogram.)
                                         COMMENTS:  APPROPRIATE DRUG CHOICE.
                                                    RHYTHM UNALTERED BY YOUR MEASURE.
Response.................................Rhythm unaltered by your measure.
Final Rhythm.............................Fine ventricular fibrillation.
While we're on the subject of sodium bicarbonate, I agree with your dosage.
--------------------------------------------------------------------------------
Time in minutes..........................6
Rhythm treated...........................Fine ventricular fibrillation
pH after treatment.......................7.18
Treatment chosen.........................Epinephrine 1:10000 (cc)
Dose chosen..............................3 TOTAL (which was 0.23 per kilogram.)
                                         COMMENTS:  APPROPRIATE DRUG CHOICE
                                                    RHYTHM ALTERED BY YOUR MEASURE.
Response.................................Rhythm altered by your measure.
Final Rhythm.............................Coarse ventricular fibrillation.
While we're on the subject of epinephrine, your dose seems a bit high.
I wouldn't ordinarily use more than 0.15 cc/kg.
THE MYOCARDIUM IS IRRITABLE.
--------------------------------------------------------------------------------
Time in minutes..........................8
Rhythm treated...........................Coarse ventricular fibrillation
pH after treatment.......................7.10
Treatment chosen.........................Defibrillation (watt-sec)
Dose chosen..............................20 TOTAL (which was 1.5 per kilogram.)
                                         COMMENTS: APPROPRIATE DRUG CHOICE
                                                   RHYTHM ALTERED BY YOUR MEASURE.
Response.................................Rhythm altered by your measure.
Final Rhythm.............................Normal sinus rhythm
While we're on the subject of defibrillation, I agree with your dosage.

You left the patient in normal sinus rhythm. This supports the circulation adequately. Good work, Doctor!
```

Figure 3. Evaluation portion of the simulation. Program contains a wide spectrum of comments to deal with other user choices.

problem, as the physician tries to think of alternatives which will restore his patient's heart beat.

I have written a program entitled "Cardiac Arrest Simulation Program," or CASP, which is a simulation of a situation in which a patient has had or will soon have a cardiac arrest. The program user is required to intervene with drugs that would actually be available to him. After the physician has either saved the patient or given up, the computer prints out an evaluation of every step that the physician took during the resuscitation procedure. A graphic summary is also provided. There are no identical simulations (i.e. the simulation is stochastic), and the physician can practice as long as desired.

CASP is written in an enhanced HP Basic for use on the HP 9845B desktop computer. It requires 50K RAM, which includes extensive documentation. I am preparing a version for the Apple II microcomputer, which will allow more widespread use of the program. The program is currently in use in our intensive care unit as a teaching tool. Interns and residents practice cardiac resuscitation at the terminal before encountering the real life situation. Several senior residents have used the program as a practice patient with which to teach interns and medical students about cardiac resuscitation. All users agree that the program has enhanced their performance in actual emergencies.

Mannequins are used widely to practice the mechanics of CPR, but no one has yet devised a way to use them to teach drug administration.

The beginning of a typical run is shown in Figure 1. The patient is described as having "fine ventricular fibrillation." He weighs 13 kilograms. The time elapsed since the heart began fibrillating is three minutes. Fine ventricular fibrillation is a situation in which the heart does not pump any blood, so the patient is unconscious. He will die soon if the heart beat is not resumed.

During cardiac arrest, the acid builds up in the blood and the pH (a measure of acidity) drops. Thus, one measure which must be taken early is correction of the acidity with administration of sodium bicarbonate. Figure 2 shows the initial commands which were used in this

```
CARDIAC ARREST SIMULATION EVALUATION REPORT.
THE INITIAL RHYTHM OF THE PATIENT WAS VENTRICULAR TACHYCARDIA.
THE INITIAL pH OF THE PATIENT WAS 6.99
THE TIME PRIOR TO RESUSCITATION EFFORTS WAS 8 MINUTES
THE WEIGHT OF THE PATIENT IS 77 KILOGRAMS.
------------------------------------------------------------------
Time in minutes.........................8
Rhythm treated..........................Ventricular tachycardia
pH after treatment......................6.99
Treatment chosen........................No intervention. Rhythm spontaneously altered.
Response................................Rhythm affected.
Final rhythm............................Coarse ventricular fibrillation.
pH BADLY NEEDS CORRECTION.
------------------------------------------------------------------
Time in minutes.........................8
Rhythm treated..........................Coarse ventricular fibrillation.
pH after treatment......................6.99
Treatment chosen........................No intervention. Rhythm spontaneously altered.
Response................................Rhythm affected.
Final rhythm............................Fine ventricular fibrillation
pH BADLY NEEDS CORRECTION.
------------------------------------------------------------------
Time in minutes.........................8
Rhythm treated..........................Fine ventricular fibrillation
pH after treatment......................6.99
Treatment chosen........................No intervention. Rhythm spontaneously altered.
Response................................Rhythm affected.
Final rhythm............................Cardiac standstill.
pH BADLY NEEDS CORRECTION.
```

Figure 5. Spontaneous deterioration of rhythm without treatment. Rhythm instability is exaggerated in this example to accelerate changes.

particular simulation. The menu from Figure 1 remains on the screen, and drugs are selected by numbers. The clock changes according to the amount of time it would require in real life to administer a drug. The physician followed the sodium bicarbonate with epinephrine and finally with electric shock (defibrillation) to restore the heart beat to normal. At this point, the program provides the physician with an evaluation of each step (Figure 3). In this particular example, the physician used correct doses and drugs. If drugs were not correct, the computer would provide pertinent negative feedback. High or toxic doses would cause harmful side effects. Low doses would be ineffective.

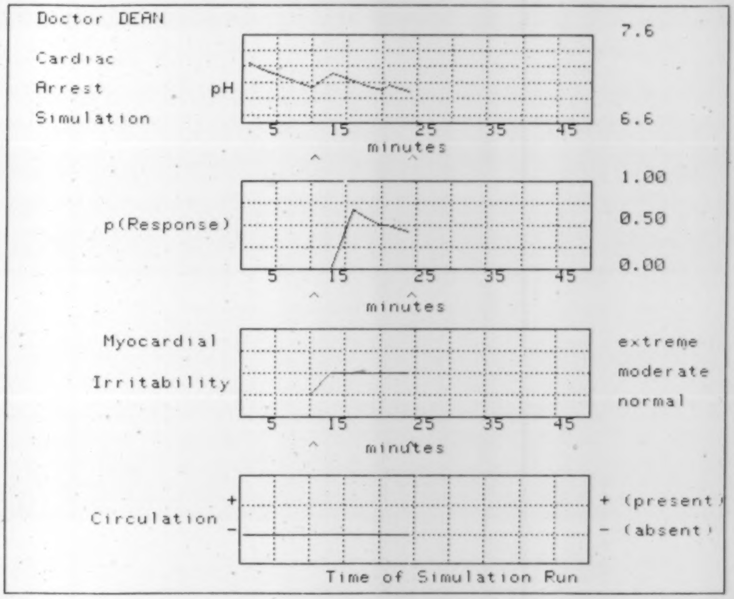

Figure 4. Graphic summary of arrest simulation. This summary is a different simulation than the other example figures.

At the end of the evaluation, a graphic summary of the run is provided (Figure 4). The top graph shows the acid content (pH) of the blood during the arrest. The more acidic the blood, the lower the pH. The second graph shows the probability of response. This is a parameter which is used by the program to determine whether a response will occur (by comparing it to a random number). This parameter is based on the duration on the rhythm, the pH, the dose of the drug, the irritability of the heart (myocardial irritability), and appropriateness of the drug selection. If the random number is less than the parameter, a response occurs. The third graph shows the myocardial irritability (which is merely a flag with three possible values). The fourth graph shows the presence or absence of circulation. Hopefully the program ends with circulation present!

Figure 5 shows a similar situation, but the physician in this case does not intervene. I have accelerated responses in this figure to show a rapid deterioration of the cardiac rhythm. Thus, the patient will become worse with time if the physician does not intervene expeditiously.

Simulations have been successfully used in many fields, particularly for dangerous tasks or situations in which beginner's mistakes could cause injury or result in other serious consequences. With the continuing explosion of microcomputer technology, such programs will appear in other fields, such as medicine. Hopefully, this will improve the quality of medical education and patient care. ☐

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An all-inclusive version of this most popular of card games. This program both BIDS and PLAYS either contract or duplicate bridge. Depending on the contract, your computer opponents will either play the offense OR defense. If you bid too high, the computer will double your contract! BRIDGE 2.0 provides challenging entertainment for advanced players and is an excellent learning tool for the bridge novice. See the software review in 80 Software Critique. Rated #1 by Creative Computing.

HEARTS 1.5 (Available for all computers) **Price: $15.95 Cassette/$19.95 Diskette**
An exciting and entertaining computer version of this popular card game. Hearts is a trick-oriented game in which the purpose is not to take any hearts or the queen of spades. Play against two computer opponents who are armed with hard-to-beat playing strategies. HEARTS 1.5 is an ideal game for introducing the uninitiated (your spouse) to computers. See the software review in 80 Software Critique.

STUD POKER (Atari only) **Price: $11.95 Cassette/$15.95 Diskette**
This is the classic gambler's card game. The computer deals the cards one at a time and you (and the computer) bet on what you see. The computer does not cheat and *usually* bets the odds. However, it sometimes bluffs! Also included is a five card draw poker betting practice program. This package will run on a 16K ATARI. Color, graphics, sound. See review in COMPUTE.

POKER PARTY (Available for all computers) **Price: $17.95 Cassette/$21.95 Diskette**
POKER PARTY is a draw poker simulation based on the book, POKER, by Oswald Jacoby. This is the most comprehensive version available for microcomputers. The party consists of yourself and six other (computer) players. Each of these players (you will get to know them) has a different personality in the form of a varying propensity to bluff or fold under pressure. Practice with POKER PARTY before going to that expensive game tonight! Apple Cassette and diskette versions require a 32 K (or larger) Apple II.

CRIBBAGE 2.0 (TRS-80 only) **Price: $14.95 Cassette/$18.95 Diskette**
This is simply the best cribbage game available. It is an excellent program for the cribbage player in search of a worthy opponent as well as for the novice wishing to improve his game. The graphics are superb and assembly language routines provide rapid execution. See the software review in 80 Software Critique.

THOUGHT PROVOKERS

MANAGEMENT SIMULATOR (Atari, North Star and CP/M only) **Price: $19.95 Cassette**
$23.95 Diskette
This program is both an excellent teaching tool as well as a stimulating intellectual game. Based upon similar games played at graduate business schools, each player or team controls a company which manufacturers three products. Each player attempts to outperform his competitors by setting selling prices, production volumes, marketing and design expenditures etc. The most successful firm is the one with the highest stock price when the simulation ends.

FLIGHT SIMULATOR (Available for all computers) **Price: $17.95 Cassette/$21.95 Diskette**
A realistic and extensive mathematical simulation of take-off, flight and landing. The program utilizes aerodynamic equations and the characteristics of a real airfoil. You can practice instrument approaches and navigation using radials and compass headings. The more advanced flyer can also perform loops, half-rolls and similar aerobatic maneuvers. Although this program does not employ graphics, it is exciting and very addictive. See the software review in COMPUTRONICS. Runs in 16K Atari.

VALDEZ (Available for all computers) **Price: $15.95 Cassette/$19.95 Diskette**
VALDEZ is a computer simulation of supertanker navigation in the Prince William Sound/Valdez Narrows region of Alaska. Included in this simulation is a realistic and extensive 256 × 256 element map, portions of which may be viewed using the ship's alphanumeric radar display. The motion of the ship itself is accurately modelled mathematically. The simulation also contains a model for the tidal patterns in the region, as well as other traffic (outgoing tankers and drifting icebergs). Chart your course from the Gulf of Alaska to Valdez Harbor! See the software review in 80 Software Critique.

BACKGAMMON 2.0 (Atari, North Star and CP/M only) **Price: $14.95 Cassette/$18.95 Diskette**
This program tests your backgammon skills and will also improve your game. A human can compete against a computer or against another human. The computer can even play against itself. Either the human or the computer can double or generate dice rolls. Board positions can be created or saved for replay. BACKGAMMON 2.0 plays in accordance with the official rules of backgammon and is sure to provide many fascinating sessions of backgammon play.

CHECKERS 3.0 (PET only) **Price: $16.95 Cassette/$20.95 Diskette**
This is one of the most challenging checkers programs available. It has 10 levels of play and allows the user to change skill levels at any time. Although providing a very tough game at level 4-8, CHECKERS 3.0 is practically unbeatable at levels 9 and 10.

CHESS MASTER (North Star and TRS-80 only) **Price: $19.95 Cassette/$23.95 Diskette**
This complete and very powerful program provides five levels of play. It includes castling, en passant captures and the promotion of pawns. Additionally, the board may be preset before the start of play, permitting the examination of "book" plays. To maximize execution speed, the program is written in assembly language (by SOFTWARE SPECIALISTS of California). Full graphics are employed in the TRS-80 version, and two widths of alphanumeric display are provided to accommodate North Star users. See review in onComputing.

LEM LANDER (32K Apple Disk only) **Price: $16.95 Diskette**
Pilot your LEM LANDER to a safe landing on any of nine different surfaces ranging from smooth to treacherous. The game paddles are used to control craft attitude and thrust. This is a real-time high res challenge!

FOREST FIRE! (Atari only) **Price: $16.95 Cassette/$20.95 Diskette**
Using excellent graphics and sound effects, this simulation puts you in the middle of a forest fire. Your job is to direct operations to put out the fire while compensating for changes in wind, weather and terrain. Not protecting valuable structures can result in startling penalties. Life-like variables are provided to make FOREST FIRE! very suspenseful and challenging. No two games have the same setting and there are 3 levels of difficulty.

NOMINOES JIGSAW (Atari, Apple and TRS-80 only) **Price: $16.95 Cassette/$20.95 Diskette**
A jigsaw puzzle on your computer! Complete the puzzle by selecting your pieces from a table consisting of 60 different shapes. NOMINOES JIGSAW is a virtuoso programming effort. The graphics are superlative and the puzzle will challenge you with its three levels of difficulty. Scoring is based upon the number of guesses taken and by the difficulty of the board set-up. See review in ELECTRONIC GAMES.

MONARCH (Atari only) **Price: $11.95 Cassette/$15.95 Diskette**
MONARCH is a fascinating economic simulation requiring you to survive an 8-year term as your nation's leader. You determine the amount of acreage devoted to industrial and agricultural use, how much food to distribute to the populace and how much should be spent on pollution control. You will find that all decisions involve a compromise and that it is not easy to make everyone happy.

CHOMPELO (Atari only) **Price: $11.95 Cassette/$15.95 Diskette**
CHOMPELO is really two challenging games in one. One is similar to NIM; you must bite off part of a cookie, but avoid taking the poisoned portion. The other game is the popular board game REVERSI. It fully uses the Atari's graphics capability, and is hard to beat. This package will run on a 16K system.

SPACE LANES (Available for all computers) **Price: $14.95 Diskette**
SPACE LANES is a simple but exciting space transportation game which involves up to four players (including the computer). The object is to form and expand space transportation companies in a competitive environment. The goal is to amass more net worth than your opponent. The economics include stock purchases and company mergers. Watch your wealth grow!

*ATARI, PET, TRS-80, NORTHSTAR, CP/M and IBM are registered tradenames and/or trademarks.

**Except where noted, all model I software is available for the Model III. TRS-80 diskettes are not supplied with DOS or BASIC.

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STARTREK 3.2 (Available for all computers) **Price: $11.95 Cassette/$15.95 Diskette**
This is the classic Startrek simulation, but with several new features. For example, the Klingons now shoot at the Enterprise without warning while also attacking starbases in other quadrants. The Klingons also attack with both light and heavy cruisers and move when shot at! The situation is hectic when the Enterprise is besieged by three heavy cruisers and a starbase S.O.S. is received! The Klingons get even! See the software reviews in A.N.A.L.O.G., 80 Software Critique and Game Merchandising.

BLACK HOLE (Apple only) **Price: $14.95 Cassette/$18.95 Diskette**
This is an exciting graphical simulation of the problems involved in closely observing a black hole with a space probe. The object is to enter and maintain, for a prescribed time, an orbit close to a small black hole. This is to be achieved without coming so near the anomaly that the tidal stress destroys the probe. Control of the craft is realistically simulated using side jets for rotation and main thrusters for acceleration. This program employs Hi-Res graphics and is educational as well as challenging.

SPACE TILT (Apple and Atari only) **Price: $10.95 Cassette/$14.95 Diskette**
Use the game paddles to tilt the plane of the TV screen to "roll" a ball into a hole in the screen. Sound simple? Not when the hole gets smaller and smaller! A built-in timer allows you to measure your skill against others in this habit-forming action game.

MOVING MAZE (Apple and Atari only) **Price: $10.95 Cassette/$14.95 Diskette**
MOVING MAZE employs the games paddles to direct a puck from one side of a maze to the other. However, the maze is dynamically (and randomly) built and is continually being modified. The objective is to cross the maze without touching (or being hit by) a wall. Scoring is by an elapsed time indicator, and three levels of play are provided.

ALPHA FIGHTER (Atari only) **Price: $14.95 Cassette/$18.95 Diskette**
Two excellent graphics and action programs in one! ALPHA FIGHTER requires you to destroy the alien starships passing through your sector of the galaxy. ALPHA BASE is in the path of an alien UFO invasion; let five UFO's get by and the game ends. Both games require the joystick and get progressively more difficult the higher you score! ALPHA FIGHTER will run on 16K systems.

THE RINGS OF THE EMPIRE (Atari only) **Price: $16.95 Cassette/$20.95 Diskette**
The empire has developed a new battle station protected by rotating rings of energy. Each time you blast through the rings and destroy the station, the empire develops a new station with more protective rings. This exciting game runs on 16K systems, employs extensive graphics and sound and can be played by one or two players.

INTRUDER ALERT (Atari only) **Price: $16.95 Cassette/$20.95 Diskette**
This is a fast paced graphics game which places you in the middle of the "Dreadstar" having just stolen its plans. The droids have been alerted and are directed to destroy you at all costs. You must find and enter your ship to escape with the plans. Five levels of difficulty are provided. INTRUDER ALERT requires a joystick and will run on 16K systems.

GIANT SLALOM (Atari only) **Price: $14.95 Cassette/$18.95 Diskette**
This real-time action game is guaranteed addictive! Use the joystick to control your path through slalom courses consisting of both open and closed gates. Choose from different levels of difficulty, race against other players or simply take practice runs against the clock. GIANT SLALOM will run on 16K systems.

TRIPLE BLOCKADE (Atari only) **Price: $14.95 Cassette/$18.95 Diskette**
TRIPLE BLOCKADE is a two-to-three player graphics and sound action game. It is based on the classic video arcade game which millions have enjoyed. Using the Atari joysticks, the object is to direct your blockading line around the screen without running into your opponent(s). Although the concept is simple, the combined graphics and sound effect lead to "high anxiety"

GAMES PACK I (Available for all computers) **Price: $10.95 Cassette/$14.95 Diskette**
GAMES PACK I contains the classic computer games of BLACKJACK, LUNAR LANDER, CRAPS, HORSERACE, SWITCH and more. These games have been combined into one large program for ease in loading. They are individually accessed by a convenient menu. This collection is worth the price just for the DYNACOMP version of BLACKJACK.

GAMES PACK II (Available for all computers) **Price: $10.95 Cassette/$14.95 Diskette**
GAMES PACK II includes the games CRAZY EIGHTS, JOTTO, ACEY-DUCEY, LIFE, WUMPUS and others. As with GAMES PACK I, all the games are loaded as one program and are called from a menu. You will particularly enjoy DYNACOMP's version of CRAZY EIGHTS.

Why pay $7.95 or more per program when you can buy a DYNACOMP collection for just $10.95?

MOON PROBE (Atari and North Star only) **Price: $11.95 Cassette/$15.95 Diskette**
This is an extremely challenging "lunar lander" program. The user must drop from orbit to land at a predetermined target on the moon's surface. You control the thrust and orientation of your craft plus direct the rate of descent and approach angle.

SPACE TRAP (Atari only, 16K) **Price: $14.95 Cassette/$18.95 Diskette**
This galactic "shoot'em up" arcade game places you near a black hole. You control your spacecraft using the joystick and attempt to blast as many of the alien ships as possible before the black hole closes about you.

ADVENTURE

CRANSTON MANOR ADVENTURE (North Star and CP/M only) **Price: $21.95 Diskette**
At last! A comprehensive Adventure game for North Star and CP/M systems. CRANSTON MANOR ADVENTURE takes you into mysterious CRANSTON MANOR where you attempt to gather fabulous treasures. Lurking in the manor are wild animals and robots who will not give up the treasures without a fight. The number of rooms is greater and the associated descriptions are much more elaborate than the current popular series of Adventure programs, making this game the top in its class. Play can be stopped at any time and the status stored on diskette.

GUMBALL RALLY ADVENTURE (North Star only, 48K) **Price: $21.95 Diskette**
Take part in this outlaw race from the east coast to the west coast. The goal is to find your way to the finish line while maintaining the highest possible speed. You may choose one of five cars available at the garage. The choice will affect your speed and range. Remember to take spare parts and don't get caught speeding!

SPEECH SYNTHESIS

DYNACOMP is now distributing the new and revolutionary TYPE-'N-TALK^{TM} (TNT) speech synthesizer from Votrax. Simply connect TNT to your computer's serial interface, enter text from the keyboard and hear the words spoken. TNT is the easiest-to-program speech synthesizer on the market. It uses the least amount of memory and provides the most flexible vocabulary available anywhere!

Price: $329.95 (Please add $4.00 for shipping and handling)

TNT Software

The following DYNACOMP programs are available for use with TNT:

STUD POKER (Atari, 24K)
NOMINOES JIGSAW (Atari, 24K)
TEACHER'S PET I (Atari and North Star)
BRIDGE 2.0 (North Star)
CHOMPELO (Atari, 24K)

TALK TO ME (T'N'T Atari only, 24K) **Price: $14.95 Cassette/$18.95 Diskette**
This program presents a superb tutorial on speech synthesis using the Atari 800 and TYPE 'N TALK^{TM}. TALK TO ME will illustrate normal word generation as well as phoneme generation. The documentation includes many helpful programming tips.

Please specify 'TNT' versions when ordering.

ABOUT DYNACOMP

DYNACOMP is a leading distributor of small system software with sales spanning the world (currently in excess of 40 countries). During the past two years we have greatly enlarged the DYNACOMP product line, but have maintained and improved our high level of quality and customer support. The achievement in quality is apparent from our many repeat customers and the software reviews in such publications as COMPUTRONICS, 80 Software Critique and A.N.A.L.O.G. Our customer support is as close as your phone. It is always friendly. The staff is highly trained and always willing to discuss products or give advice.

BUSINESS and UTILITIES

SPELLGUARD™ (CP/M only) — **Price: $219.95 Disk**
SPELLGUARD is a revolutionary new product which increases the value of your current word processing system (WORDSTAR, MAGIC WAND, ELECTRIC PENCIL, TEXTED EDITOR II and others). Written entirely in assembly language, SPELLGUARD™ rapidly assists the user in eliminating spelling and typographical errors by comparing each word of the text against a dictionary (expandable) of over 20,000 of the most common English words. Words appearing in the text but not found in the dictionary are "flagged" for easy identification and correction. Most administrative staff familiar with word processing equipment will be able to use SPELLGUARD™ in only a few minutes.

MAIL LIST 2.2 (Apple, Atari and North Star diskette only) — **Price: $34.95**
This program is unmatched in its ability to store a maximum number of addresses on one diskette (minimum of 1100 per diskette, more than 2200 for "double density" systems!). Its many features include alphabetic and zip code sorting, label printing (1, 2, or 3 up), merging of files and a unique keyword seeking routine which retrieves entries by a virtually limitless selection of user defined codes. Mail List 2.2 will even find and delete duplicate entries. A very valuable program!

FORM LETTER SYSTEM rel. 2 (Atari, North Star and Apple Diskettes only) — **Price: $34.95**
FORM LETTER SYSTEM (FLS) is the ideal program for creating and editing form letters and address lists. It contains an easy-to-use text editor which produces fully justified text. Special codes are used in the address list to obtain personalized salutations. Form letters are produced by automatically inserting each address into a predetermined portion of your letter. FLS is completely compatible with MAIL LIST 2.2, which may be used to manage and sort your address files.

FLS and MAIL LIST 2.2 are available as a combined package for $59.95.

SORTIT (North Star only) — **Price: $29.95 Diskette**
SORTIT is a general purpose sorting program written in 8080 assembly language. This program will sort sequential data files generated by NORTH STAR BASIC. Primary and optional secondary keys may be numeric or one to nine character strings. SORTIT is easily used with files generated by DYNACOMP's MAIL LIST program and is very versatile in its capabilities for all other BASIC data file sorting.

PERSONAL FINANCE SYSTEM (Atari and North Star only) — **Price: $34.95 Diskette**
PFS is a single diskette, menu-oriented system composed of ten different programs. Besides recording your expenses and tax deductible items, PFS will sort and summarize expenses by payee, and display information on expenditures by any of 26 user defined codes by month or by payee. PFS will even produce monthly bar graphs of your expenses by category! This powerful package requires only one disk drive, minimal memory (24K Atari, 32K North Star) and will store up to 600 records per disk (and over 1000 records per disk by making a few simple changes to the programs). You can record checks plus cash expenses so that you can finally see where your money goes and eliminate guesswork and tedious hand calculations.

FAMILY BUDGET (Apple only) — **Price: $34.95 Diskette**
FAMILY BUDGET is a very convenient financial record-keeping program. You will be able to keep track of cash and credit expenditures as well as income on a daily basis. You can record tax deductible items and charitable donations. FAMILY BUDGET also provides a continuous record of all credit transactions. You can make daily cash and charge entries to any of 21 different expense accounts as well as to 5 payroll and tax accounts. Data are easily retrieved giving the user complete control over an otherwise complicated (and unorganized!) subject.

INTELINK (Atari only) — **Price: $49.95 Diskette**
This software package contains a menu-driven collection of programs for facilitating efficient two-way communications through a full duplex modem (required for use). In one mode of operation you may connect to a data service (e.g., The SOURCE or MicroNet) and quickly load data such as stock quotations onto your diskette for later viewing. This greatly reduces "connect time" and thus the service charge. You may also record the complete contents of a communications session. Additionally, programs written in BASIC, FORTRAN, etc. may be built off-line using the support text editor and later "uploaded" to another computer, making the Atari a *very* smart terminal. Even Atari BASIC programs may be uploaded. Further, a command file may be built off-line and used later as controlling input for a time-share system. That is, you can set up your sequence of time-share commands and programs, and the Atari will transmit them as needed; batch processing. All this adds up to saving both connect time and your time.

TEXT EDITOR II (CP/M) — **Price: $29.95 Diskette/$33.45 Disk**
This is the second release version of DYNACOMP's popular TEXT EDITOR I and contains many new features. With TEXT EDITOR II you may build text files in chunks and assemble them for later display. Blocks of text may be appended, inserted or deleted. Files may be saved on disk/diskette in right justified/censered format to be later printed by either TEXT EDITOR II or the CP/M ED facility. Futher, ASCII CP/M files (including BASIC and assembly language programs) may be read by the editor and processed. In fact, text files can be built using ED and later formatted using TEXT EDITOR II. All in all, TEXT EDITOR II is an inexpensive, easy to use, but very flexible editing system.

DFILE (Atari and North Star diskettes only) — **Price: $19.95**
This handy program allows North Star and Atari disk users to maintain a specialized data base of all files and programs in the stack of disks which invariably accumulates. DFILE is easy to set up and use. It will organize your disks to provide efficient locating of the desired file or program.

FINDIT (North Star only) — **Price: $19.95**
This is a three-in-one program which maintains information accessible by keywords of three types: Personal (eg: last name), Commercial (eg: plumbers) and Reference (eg: magazine articles, record albums, etc). In addition to keyword searches, there are birthday, anniversary and appointment searches for the personal records and appointment searches for the commercial records. Reference records are accessed by a single keyword or by cross-referencing two or three keywords.

SHOPPING LIST (Atari and North Star only) — **Price: $12.95 Cassette/$16.95 Diskette**
SHOPPING LIST stores information on items you purchase at the supermarket. Before going shopping, it will remind you of all the things you might need, and then display (or optionally print) your shopping list and the total cost. Adding, deleting, changing and storing data is very easy. Runs with 16K.

TAX OPTIMIZER (North Star only) — **Price: $59.95 Diskette**
The TAX OPTIMIZER is an easy-to-use, menu oriented software package which provides a convenient means for analyzing various income tax strategies. The program is designed to provide a quick and easy data entry. Income tax is computed by all tax methods (regular, income averaging, maximum and alternate minimum tax). The user may immediately observe the tax effect of critical financial decisions. TAX OPTIMIZER has been thoroughly field tested in CPA offices and comes complete with the current tax tables in its data files.

EDUCATION

HODGE PODGE (Apple only, 48K Applesoft or Integer BASIC) — **Price: $19.95 Cassette/$23.95 Diskette**
Let HODGE PODGE be your child's baby sitter. Pressing any key on your Apple will result in a different and intriguing "happening" related to the letter or number of the chosen key. The program's graphics, color and sound are a delight for children from ages 1½ to 9. HODGE PODGE is a non-intimidating teaching device which brings a new dimension to the use of computers in education.

TEACHER'S PET I (Available for all computers) — **Price: $11.95 Cassette/$15.95 Diskette**
This is the first of DYNACOMP's educational packages. Primarily intended for pre-school to grade 3, TEACHER'S PET provides the young student with counting practice, letter-word recognition and three levels of math skill exercises.

MISCELLANEOUS

CRYSTALS (Atari only) — **Price: $ 9.95 Cassette/$13.95 Diskette**
A unique algorithm randomly produces fascinating graphics displays accompanied with tones which vary as the patterns are built. No two patterns are the same, and the combined effect of the sound and graphics are mesmerizing. CRYSTALS has been used in local stores to demonstrate the sound and color features of the Atari.

NORTH STAR SOFTWARE EXCHANGE (NSSE) LIBRARY
DYNACOMP now distributes the 23 volume NSSE library. These diskettes each contain many programs and offer an outstanding value for the purchase price. They should be part of every North Star user's collection. Call or write DYNACOMP for details regarding the contents of the NSSE collection.

Price: $9.95 each/$7.95 each (4 or more)
The complete collection may be purchased for $149.95

DYNACOMP CASSETTES

DYNACOMP now offers high quality DYNACOMP brand name C-20 cassettes for computer use. Each cassette is guaranteed to be defect-free.

Box of 10 cassettes:	$15.95 postpaid
Box of 20 cassettes:	$29.95 postpaid

AVAILABILITY

DYNACOMP software is supplied with complete documentation containing clear explanations and examples. Unless otherwise specified, all programs will run within 16K program memory space (ATARI requires 24K). Except where noted, programs are available on ATARI, PET, TRS-80 (Level II) and Apple (Applesoft) cassette and diskette as well as North Star single density (double density compatible) diskette. Additionally, most programs can be obtained on standard (IBM format) 8" CP/M floppy disks for systems running under MBASIC.

STATISTICS and ENGINEERING

DIGITAL FILTER (Available for all computers) — **Price: $39.95 Cassette/$43.95 Diskette**
DIGITAL FILTER is a comprehensive data processing program which permits the user to design his own filter function or choose from a menu of filter forms. The filter forms are subsequently converted into non-recursive convolution coefficients which permit rapid data processing. In the explicit design mode the shape of the frequency transfer function is specified by directly entering points along the desired filter curve. In the menu mode, ideal low pass, high pass and bandpass filters may be approximated to varying degrees according to the number of points used in the calculation. These filters may optionally also be smoothed with a Hanning function. In addition, multi-stage Butterworth filters may be selected. Features of DIGITAL FILTER include plotting of the data before and after filtering, as well as display of the chosen filter functions. Also included are convenient data storage, retrieval and editing procedures.

DATA SMOOTHER (Not available for Atari) — **Price: $19.95 Cassette/$23.95 Diskette**
This special data smoothing program may be used to rapidly derive useful information from noisy business and engineering data which are equally spaced. The software features choice in degree and range of fit, as well as smoothed first and second derivative calculation. Also included is automatic plotting of the input data and smoothed results.

FOURIER ANALYZER (Available for all computers) — **Price: $19.95 Cassette/$23.95 Diskette**
Use this program to examine the frequency spectra of limited duration signals. The program features automatic scaling and plotting of the input data and results. Practical applications include the analysis of complicated patterns in such fields as electronics, communications and business.

TFA (Transfer Function Analyzer) — **Price: $19.95 Cassette/$23.95 Diskette**
This is a special software package which may be used to evaluate the transfer functions of systems such as hi-fi amplifiers and filters by examining their response to pulsed inputs. TFA is a major modification of FOURIER ANALYZER and contains an engineering-oriented decibel versus log-frequency plot as well as data editing features. Whereas FOURIER ANALYZER is designed for educational and scientific use, TFA is an engineering tool. Available for all computers.

HARMONIC ANALYZER (Available for all computers) — **Price: $24.95 Cassette/$28.95 Diskette**
HARMONIC ANALYZER was designed for the spectrum analysis of repetitive waveforms. Features include data file generation, editing and storage/retrieval as well as data and spectrum plotting. One particularly unique facility is that the input data need not be equally spaced or in order. The original data is sorted and a cubic spline interpolation is used to create the data file required by the FFT algorithm.

FOURIER ANALYZER, TFA and HARMONIC ANALYZER may be purchased together for a combined price of $49.95 (three cassettes) and $59.95 (three diskettes).

REGRESSION I (Available for all computers) — **Price: $19.95 Cassette/$23.95 Diskette**
REGRESSION I is a unique and exceptionally versatile one-dimensional least squares "polynomial" curve fitting program. Features include very high accuracy; an automatic degree determination option; an extensive internal library of fitting functions; data editing; automatic data and curve plotting; a statistical analysis (eg: standard deviation, correlation coefficient, etc.) and much more. In addition, new fits may be tried without reentering the data. REGRESSION I is certainly the cornerstone program in any data analysis software library.

REGRESSION II (PARAFIT) (Available for all computers) — **Price: $19.95 Cassette/$23.95 Diskette**
PARAFIT is designed to handle those cases in which the parameters are imbedded (possibly nonlinearly) in the fitting function. The user simply inserts the functional form, including the parameters (A(1), A(2), etc.) as one or more BASIC statement lines. Data and results may be manipulated and plotted as with REGRESSION I. Use REGRESSION I for polynomial fitting, and PARAFIT for those complicated functions.

MULTILINEAR REGRESSION (MLR) (Available for all computers) — **Price: $24.95 Cassette/$28.95 Diskette**
MLR is a professional software package for analyzing data sets containing two or more linearly independent variables. Besides performing the basic regression calculation, this program also provides easy to use data entry, storage, retrieval and editing functions. In addition, the user may interrogate the solution by supplying values for the independent variables. The number of variables and data size is limited only by the available memory.

REGRESSION I, II and MULTILINEAR REGRESSION may be purchased together for $51.95 (three cassettes) or $63.95 (three diskettes).

ANOVA (Available for all computers) — **Price: $39.95 Cassette/$43.95 Diskette**
In the past the ANOVA (analysis of variance) procedure has been limited to the large mainframe computers. Now DYNACOMP has brought the power of this method to small systems. For those conversant with ANOVA, the DYNACOMP software package includes the 1-way, 2-way and N-way procedures. Also provided are the Yates 2^{K-P} factorial designs. For those unfamiliar with ANOVA, do not worry. The accompanying documentation was written in a tutorial fashion (by a professor in the subject) and serves as an excellent introduction to the subject. Accompanying ANOVA is a support program for building the data base. Included are several convenient features including data editing, deleting and appending.

BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2 (Not available for Atari)
DYNACOMP is the exclusive distributor for the software keyed to the popular texts *BASIC SCIENTIFIC SUBROUTINES, Volumes I and 2* by F. Ruckdeschel (see advertisements in BYTE magazine). These subroutines have been assembled according to chapter. Included with each collection is a menu program which selects and demonstrates each subroutine.

Volume 1

Collection #1:	Chapters 2 and 3 - Data and function plotting; complex variables and functions.
Collection #2:	Chapter 4 - Extended matrix and vector operations.
Collection #3:	Chapters 5 and 6 - Random number generators (Poisson, Gaussian, etc.); series approximations.

Price per collection: $14.95 Cassette/$18.95 Diskette
All three collections are available for $39.95 (three cassettes) and $49.95 (three diskettes).

Volume 2

Collection #1:	Chapter 1 - Linear, polynomial, multidimensional, parametric least squares.
Collection #2:	Chapter 2 - Series approximation techniques (economization, inversion, reversion, shifting, etc.).
Collection #3:	Chapter 3 - Functional approximations by iteration and recursion.
Collection #4:	Chapter 4 - CORDIC approximations to trigonometric, hyperbolic, exponential and logarithmic functions.
Collection #5:	Chapter 5 - Table interpolation, differentiation and integration (Newton, LaGrange, splines).
Collection #6:	Chapter 6 - Methods for finding the real roots of functions.
Collection #7:	Chapter 7 - Methods for finding the complex roots of functions.
Collection #8:	Chapter 8 - Optimization by steepest descent.

Price per collection: $14.95 Cassette/$18.95 Diskette
All eight collections are available for $99.95 (eight cassettes) and $129.95 (eight diskettes).
Because the texts are a vital part of the documentation, *BASIC SCIENTIFIC SUBROUTINES, Volumes I and 2* are available from DYNACOMP:

BASIC SCIENTIFIC SUBROUTINES, Vol 1 (319 pages): $19.95 + 75¢ postage
BASIC SCIENTIFIC SUBROUTINES, Vol 2 (790 pages): $23.95 + $1.50 postage
See reviews in KILOBAUD and Dr. Dobbs.

ROOTS (Available for all computers) — **Price $10.95 Cassette/$14.95 Diskette**
In a nutshell, ROOTS simultaneously determines all the zeroes of a polynomial having real coefficients. There is no limit on the degree of the polynomial, and because the procedure is iterative, the accuracy is generally very good. No initial guesses are required as input, and the calculated roots are substituted back into the polynomial and the residuals displayed.

ACTIVE CIRCUIT ANALYSIS (ACAP) (48K Apple only) — **Price: $25.95 Cassette/$29.95 Diskette**
ACAP is the analog circuit designer's answer to LOGIC SIMULATOR. With ACAP you may analyze the response of an active or passive component circuit (e.g., a transistor amplifier, band pass filter, etc.). The circuit may be probed at equal steps in frequency, and the resulting complex (*i.e.*, real and imaginary) voltages at each component juncture examined. By plotting the magnitude of these voltages, the frequency response of a filter or amplifier may be completely determined with respect to both amplitude and phase. In addition, ACAP prints a statistical analysis of the range of voltage responses which result from tolerance variations in the components. ACAP is easy to learn and use. Simply describe the circuit in terms of the elements and their placement, and execute. Circuit descriptions may be saved onto cassette or diskette to be recalled at a later time for execution or editing. ACAP should be part of every circuit designer's program library.

LOGIC SIMULATOR (Apple only; 48K RAM) — **Price: $24.95 Cassette/$28.95 Diskette**
With LOGIC SIMULATOR you may easily test your complicated digital logic design with respect to given set of inputs to determine how well the circuit will operate. The elements which may be simulated include multiple input AND, OR, NOR, EXOR, EXNOR and NAND gates, as well as inverters, J-K and D flip-flops, and one-shots. The response of the system is available every clock cycle. Inputs may be clocked in with varying clock cycle lengths/displacements and delays may be introduced to probe for glitches and race conditions. At the user's option, a timing diagram for any given set of nodes may be plotted using HIRES graphics. Save your breadboarding until the circuit is checked by LOGIC SIMULATOR.

ORDERING INFORMATION

All orders are processed and shipped within 48 hours. Please enclose payment with order and include the appropriate computer information. If paying by VISA or Master Card, include all numbers on card.

Shipping and Handling Charges
Within North America: Add $1.50
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Delivery
All orders (excluding books) are sent First Class.

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Deduct 10% when ordering 3 or more programs. Dealer discount schedules are available upon request.

8" CP/M Disks
Add $2.50 to the listed diskette price for each 8" floppy disk (IBM soft sectored CP/M format). Programs run under Microsoft MBASIC or BASIC-80.

5¼" CP/M Disks
All software available on 8" CP/M disks is also available on 5¼" disks, North Star format.

Ask for DYNACOMP programs at your local software dealer. Write for detailed descriptions of these and other programs from DYNACOMP.

DYNACOMP, Inc. (Dept. C)
1427 Monroe Avenue
Rochester, New York 14618
24 hour order phone: (716)442-8731 recording
Office phone (9AM-5PM EST): (716)442-8960

New York State residents please add 7% NYS sales tax.

Murphy's Eleventh Law as it Applies to Data Entry

T. R. Todd

-I say old chap, bad show! -
Galanti '80

Definition of the Law

It is almost certain that everyone has heard of Murphy's Law at some time in their lives. Simply stated it is:

- If anything can go wrong, it will.

Applications of this principle can be seen in the NASA Space Program, in traffic tie-ups, in cooking, in virtually every facet of the human condition. Many have probably seen the corollaries to the basic law also. For instance:

- Nature always sides with the hidden flaw.
- Left to themselves, all things go from bad to worse.

In his book *The Official Rules* (1978), New York, NY, Dell Publishing Co.), Paul Dickson has put forth a comprehensive listing of Murphy's Laws. In the eleventh law, he asserts that:

- It is impossible to make anything foolproof, because fools are so ingenious.

This applies to many aspects of daily life, but it is especially applicable to the area of computers, and specifically data entry. People who do data-entry work are not fools by any means. However, with the advent of personal computing, many people are sitting down at a computer for the first time.

How It Applies to Data Entry

When someone faces a computer for the first time, there is a certain amount of anxiety in the relationship. Some never get over it. One of the many ways to overcome this problem is in the programming interface to the user. As stated in the age-old acronym, GIGO (Garbage In, Garbage Out), the only way to get good results from the computer is to get good input from the user.

It is therefore the responsibility of the program, and thus the programmer to make sure that the input to the program will produce the desired results. If this cannot be assured, then it should at least ensure that the input will not cause a program error. There can be nothing more frustrating to computer novices than to be told that they made an error when they didn't know what they were supposed to do.

IN$	String used for input and output of routine
ED(1)	Data type parameter: 1 = Character string (parameter ED(2) is required); 2 = Integer value (parameters ED(3) and ED(4) are required); 3 = Decimal value (parameters ED(3) and ED(4) are required). Also used as a return code parameter to the caller: 0 = value passed is the desired data type, was within limits, and has been formatted back into IN$; -1 = Error has occurred and user has been notified of the error and how to correct it.
ED(2)	Length of character string
ED(3)	Minimum acceptable value of integer or decimal number
ED(4)	Maximum acceptable value of integer or decimal number
ED(5)	Working variable

Figure 1. Variables Used by the Input Edit Subroutine.

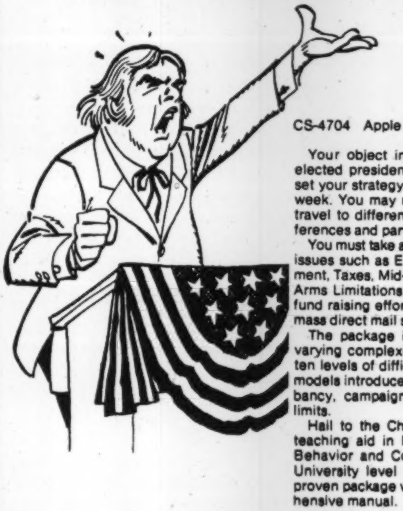
T. R. Todd, 953 Foxswallow Court, San Jose, CA 95120.

Apple II

sensational software

creative computing software

Hail to the Chief



by
Phillip W. Brashear
and
Richard G. Vance

CS-4704 Apple II Disk, 48K $24.95

Your object in this simulation is to be elected president. In your campaign you set your strategy and carry it out week by week. You may run TV or magazine ads, travel to different states, hold news conferences and participate in a debate.

You must take a position on ten campaign issues such as Energy Policy, Unemployment, Taxes, Mid-East Policy and Strategic Arms Limitations. You must manage your fund raising efforts to business, labor and mass direct mail solicitations.

The package includes four models of varying complexity; each can be used at ten levels of difficulty. The more complex models introduce the influences of incumbancy, campaign finance and spending limits.

Hail to the Chief has been used as a teaching aid in Political Science, Voting Behavior and Computer Science at the University level since 1976. It is a well proven package which includes a comprehensive manual.

Gradebook

Disk CS-4709 $24.95 Requires 32K Applesoft or Apple II Plus

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2) SCORE ENTRY uses the roster set up in CLASSFILE INITIATION to enter a class set of scores on one or more assignments.

3) SINGLE STUDENT EDITOR permits you to fill in "incompletes", correct mistakes made in SCORE ENTRY, etc.

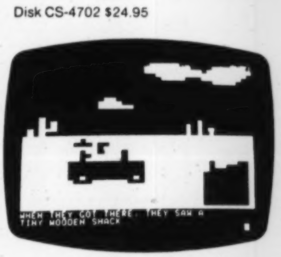
4) CLASS ROSTER CHANGE is exactly what it sounds like.

5) RECORD CHECK first summarizes the state of the class as a whole, then lets you check on how any individual is doing.

6) STATISTICAL SUMMARY can actually be run at any time you want a detailed summary of student performance for an entire class.

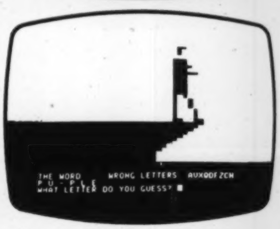
Story Time and Don't Fall

Disk CS-4702 $24.95 Requires 16K Apple II or Apple II Plus



```
WHEN THEY GOT THERE, THEY SAW A
TINY WOODEN SHACK
```

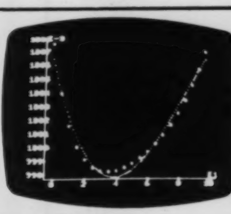
Story Time.
What's your name? Please name someone you like. What are you afraid of? Name a food you don't like. Using the answers to these questions, the computer makes up a delightful story presented with sound and full-color graphics. Over 100,000 variations are possible which incorporate different locales (desert, mountain, seashore, school yard), weather, time of day, and surprise events (find a creepy cave, haunted house, pink flying saucer and much more).



```
THE WORD      WRONG LETTERS  AUXODFZCH
P U - P L E
WHAT LETTER DO YOU GUESS? ■
```

Don't Fall.
Several new features make this adaptation of hangman better than ever. You can choose words from nine categories (sports, countries, etc.). Every letter you guess that is not in the words brings you one step closer to falling in the water. In the second part of each round you give the computer a word which it must guess, otherwise it falls in. Three skill levels.

Scientific Plotter and Curve Fitter



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Curve Fitter

Disk CS-4804, $34.95
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```
 10   DIM ED(5)
100   REM  * *
110   REM  * * ENTRY POINT OF INPUT EDIT SUBROUTINE       * *
120   REM  * *
130   ON ED(1) GOTO 230, 300, 300
140   REM  * *
150   REM  * * INPUT VALUES ARE IN ERROR                  * *
160   REM  * *
170      PRINT "INPUT ERROR TO EDIT ROUTINE"
180      PRINT "ED(1)=";ED(1);",ED(2)=";ED(2);",ED(3)=";ED(3);
190      PRINT ",ED(4)=";ED(4)
200      ED(1) = -1
210      GOTO 600
220   REM  * *
230   REM  * * CHARACTER STRING FORMATTER                 * *
240   REM  * *
250   IN$ = IN$ + "[10 SP]"
260   IF LEN(IN$) < ED(2) THEN GOTO 230
270   IN$ = LEFT$(IN$,ED(2))
280   GOTO 600
290   REM  * *
300   REM  * * ENTER HERE FOR INTEGER AND DECIMAL VALUES  * *
310   REM  * *
320   ED(5) = VAL(IN$)
330   REM  * *
340   REM  * * RANGE CHECK                                * *
350   REM  * *
360   IF ED(5) >= ED(3) AND ED(5) <= ED(4) THEN GOTO 400
370      PRINT "ERROR- VALUE MUST BE BETWEEN ";ED(3);" AND ";ED(4)
380      ED(1) = -1
390      GOTO 600
400   IN$ = STR$(ED(5))
410   ON ED(1) GOTO , 430, 500
420   REM  * *
430   REM  * * CHECK FOR INTEGER VALUE                    * *
440   REM  * *
450   IF ED(5) = INT(ED(5)) THEN GOTO 600
460      PRINT "ERROR- VALUE MUST BE AN INTEGER"
470      ED(1) = -1
480      GOTO 600
490   REM  * *
500   REM  * * FIND THE DECIMAL POINT, IF PRESENT AND     * *
510   REM  * *   FORMAT THE NUMBER TO TWO DECIMAL PLACES  * *
520   REM  * *
530   FOR I = LEN(IN$) TO 1 STEP -1
540      IF MID$(IN$,I,1) = "." THEN GOTO 580
550   NEXT
560   IN$ = IN$ + ".00"
570   GOTO 600
580   IN$ = LEFT$(IN$ + "00", I+2)
590   REM  * *
600   REM  * * COMMON EXIT POINT FROM INPUT EDIT SUBROUTINE *
610   REM  * *
620   IF ED(1) > 0 THEN ED(1) = 0
630   RETURN
```

Figure 2. Input Data Edit Subroutine.

```
1000  PRINT "ENTER NAME ==>";  (Tell user what data you want)
1005  INPUT IN$                (Read input data)
1010  ED(1) = 1                (Set string data type)
1015  ED(2) = 13               (Set string length)
1020  GOSUB 100                (Call edit subroutine)
1025  IF ED(1) < 0 THEN        (Check for error on input)
         GOTO 1000             (If error then request data again)
1030  REM INPUT IS VALID, OPERATE ON IT.
```

Figure 3. For a Character String of Length 13.

```
2000  PRINT "ENTER NUMBER OF COPIES (BETWEEN 1 AND 10) ==>";
2005  INPUT IN$                (Read input data)
2010  ED(1) = 2                (Set integer data type)
2015  ED(3) = 1                (Set minimum value)
2020  ED(4) = 10               (Set maximum value)
2025  GOSUB 100                (Call edit subroutine)
2030  IF ED(1) < 0 THEN        (Check error on input)
         GOTO 2000             (If error request data again)
2035  REM INPUT IS VALID, OPERATE ON IT.
```

Figure 4. For an Integer from 1 to 10.

```
3000  PRINT "ENTER UNIT PRICE ==>";
3005  INPUT IN$                (Read input data)
3010  ED(1) = 3                (Set floating point data type)
3015  ED(3) = .01              (Set minimum value)
3020  ED(4) = 1000             (Set maximum value)
3025  GOSUB 100                (Call edit subroutine)
3030  IF ED(1) < 0 THEN        (Check error on input)
         GOTO 3000             (If error request data again)
3035  REM INPUT IS VALID, OPERATE ON IT.
```

Figure 5. For a Decimal Number between 0.01 and 1000.00.

In addition to this, there is the myth of the electronic brain that has been popularized by the pseudo-technical TV programs which show the "computer technician" disagreeing with the results of a computer run, and simply running the program again, with no changes, to achieve a better result.

The User-Friendly Interface

To make the user feel more relaxed, and get more done in a given amount of time, the program should lead the user through every step of the data entry in a non-threatening way. Specifically, there are three basic responsibilities that the program should bear to ease the burden on the user.

The Helpful Interface

First, the program must explicitly define the type of input it expects. If the program is for a data-entry clerk in a business environment, dealing with the same programs and data every day, the definition need not be too specific. However, the casual user may not understand the request for input data and so, for the casual user the program must be more explicit, perhaps providing more information (when requested) about a specific data element.

For instance, if the user does not understand the data request, he might have the immediate option of entering a question mark. The input routine could recognize the question mark as a request for more information about the data required, and supply the data type, minimum and maximum values, or string length. These values have all been supplied to the subroutine as parameters for its own determination of the correctness of the data; why not share this information with the user, as needed?

Second, the input itself should not generate any Operating System or Basic messages. There can be nothing more frustrating to a user than to provide a character string entry when an integer data element was requested and get the baffling message: TYPE MISMATCH ERROR.

I would recommend that all input be taken in by the program in character-string form, then internally converted to the proper data type under program control. This will eliminate many problems, and eventually much wear and tear on the keyboard.

Third, the user should be told about mistakes as they are entered, and also told why they are not considered good input. If a program expects an integer value between 1 and 99, a value of 5984.98 will clearly be out of range, but not necessarily out of the range of possibilities in the user's mind. At this point the user should be told that the input was in error, what kind of error was made, and what the program considers to be good input for that data element.

An Input Edit Subroutine

The code contained in Figure 2 is a comprehensive input editing subroutine. It requires little input from the user, and

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returns the input value to the user in the IN$ variable, edited and formatted according to the specifications provided. Figure 1 shows the input and output requirements on this routine.

If the user is asked to input some character data, the example in Figure 3 defines the calling sequence required to invoke the subroutine character input. Only the data type and the string length are required for this type of data, and the string is returned to the user formatted to the length specified. (Alternately, this routine can be used to format variable length character strings to a standard length for output in columns, left justified.)

For an integer value, the calling sequence is defined in Figure 4. For a decimal value, see Figure 5 for the invocation. Both of these data types require a range of acceptable values, as well as the data type parameter. The integer request is checked to see that the data has no fractional part, and the decimal is truncated or expanded to two decimal places regardless of the input. Upon return to the user, the data type variable ED(1) is set to zero to indicate that the input is as requested, or to -1 to indicate that an error message was issued. If the return code is zero, then the input from the user has been returned in the variable IN$, formatted according to the routine's specifications. All numeric values are formatted into a character string, and decimal numbers are either truncated or padded to two decimal places.

How the Code Works

The code shown in Figure 2 was originally written for the Apple II with the Applesoft II firmware card, and subsequently modified for the Commodore PET. The code has been formatted here to be for general use, and has none of the "tricks" available to these two systems which might make it inapplicable in other Basic dialects.

The dimension statement at line 10 should be inserted at the beginning of the program to define the structure for input to the subroutine. Entry is made to the routine at a common point, line 100, for any data type. Line 130 uses the data type parameter to choose the correct routine to be executed. If the ED(1) data type parameter is not set for each call to the subroutine, or if an invalid data type is used, the error routine at line 170 will notify the user. With any kind of luck, all entries to this routine will be thoroughly tested before it is turned over to the user, so that these messages will never be seen by the ultimate user. However, they will provide a valuable debugging tool to the program during the development process.

The character string formatter, starting at line 230, simply adds a string of ten blanks to the character string until the string length is larger than the specified length in ED(2). The string is then truncated to the specified length. Note: the code at line 250 uses the PET notation convention to indicate the 10 blanks.

At line 300, the integer and decimal value routine first converts the character string from the input statement to a numeric value in the work variable ED(5). Note: At this point, any extraneous non-numeric characters are eliminated because the VAL built-in function takes only numeric characters from the string, and only up to the first non-numeric character. Therefore, input such as "125.72G51" will be taken as "125.72." The range check is then done at line 360, and the error routine at 370 is entered if the numeric value is outside the range of the numbers specified in ED(3) and ED(4).

If the number is within range it is then converted back to a string, and the data type is once again checked to differentiate between decimals and integers. Integers are tested at line 450 to insure that no fractional part exists and, if this is true, the routine transfers control to the exit routine. An error message is printed to the user if the value contains any fractional part, and exit is made with an error return code. Decimal numbers are formatted starting at line 500 by searching for the decimal point within the string. The search is done from right to left to save time, because this routine is intended for a commercial application. In a scientific application it may save time to search for the decimal from left to right if the numbers being handled are very small. If a decimal is found, the line at 580 adds two zeros to the end of the string and truncates the string at a position two characters beyond the location of the decimal point. If a decimal point is not found, then line 560 adds a ".00" to the end of the string and goes to the common exit point.

Used properly, this interface can do much toward the advancement of computers, and specifically small computers, in our daily lives, by removing some of the mystery and difficulty from their use.

At the common exit point, line 600, the data type parameter is tested for error. If the value is non-negative, then the value is set to zero to indicate that the value passed to this routine in IN$ is now returned to IN$ and meets all of the user's specifications as passed in the ED(n) parameters. The routine then simply RETURNs to its caller.

Programming Notes

There are a few things about this routine and its invocation that bear mentioning. Line number 410 in Figure 2 makes the differentiation between decimal and integer-type numbers. These are the only types that will come to line 410, so the comma after the GOTO is there to indicate that there is a value missing, and the only addresses supplied are for cases 2 and 3. An alternate approach to this, and equally valid, is to recode the line to read:

```
410 ON (ED(1) -1) GOTO 430, 500
```

This method was not chosen because it is felt that there is less confusion to the reader of the code to indicate that a value is omitted, rather than to be constantly changing such a pivotal value as the argument of an ON...GOTO statement.

It should be the responsibility of the code which calls this subroutine to keep track of the cursor location. If the subroutine is entered with good input, then the return is made with ED(1) set to zero, and the cursor is exactly where it was left. If the input data is in error, then the subroutine will print a one-line error message and return to the caller with ED(1) set to -1. This should be an indication to the caller that there is some adjustment to be made in the cursor, as well as another input request to be made again.

The calling routine may also sound an audible alarm (if implemented) when ED(1) is returned as a -1. This is an excellent human-factor item, as the end user will be notified that an error has occurred without having to look at the screen after each item of data is entered.

Possible Changes

If the user wishes to have a variable number of decimal places—this routine was designed with a commercial application in mind—this could be easily accomplished with another input variable. Another improvement which could be made to this routine would be to allow for character-string formatting with right alignment. This could be used for columnizing numbers on reports. The code required for these improvements is left as an exercise for the reader.

The subroutine described in this article will provide the programmer with the capability of providing the user with what is termed a "user-friendly" interface. If used properly, this interface can do much toward the advancement of computers, and specifically small computers, in our daily lives, by removing some of the mystery and difficulty from their use. It may not make the process foolproof, but the techniques discussed in this article will challenge the ingenuity of fools. □

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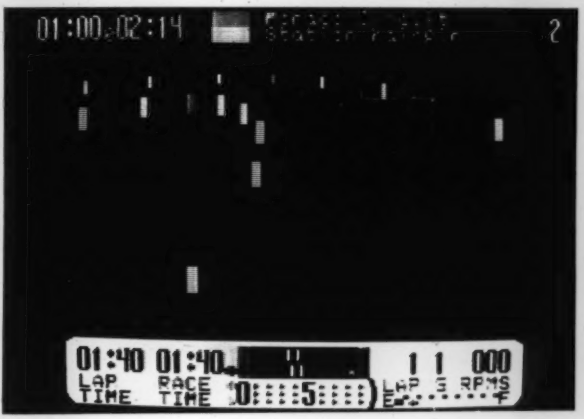

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WHO'S AFRAID OF THE BIG, BAD MATRIX ?

Keith Brewster

Beginners in Basic, as well as many people with quite a lot of experience, have real trouble understanding arrays and matrices. This may be because it is a little difficult at first to see the real value of these concepts. Once the techniques are mastered, and it becomes possible to "visualize" an array or matrix, these extremely powerful features of Basic and many other high-level languages become useful tools. The purpose of this article is to introduce these concepts and a few of the techniques involved in matrix/array programming, and to point out some of the places where arrays can be used.

What is an Array

An "array" is like a list. Visualize it as a vertical stack of boxes. The boxes are piled up, and the stack is one box wide and several boxes high. Thus the pile has only *one dimension*, that of height. It is only one box wide, so it has no width. There is no depth, either.

The computer doesn't see things quite this way, but since what it does is totally "transparent" or "invisible" to the user, we don't really care. The stack of boxes is convenient for human minds to picture, and we can draw it on a piece of paper. But what good is a pile of boxes if the boxes are empty? Can't we put something useful in them? The boxes are called variables, and they function just as any other Basic variable functions. Each box can store a number or a string (unless you are using Atari Basic, which can store only numbers in an array or matrix...strings are handled differently.) Figure 1 shows how our stack of boxes or variables, collectively called an array, should be visualized.

```
+-----+
!  8  !    (Box 1 contains 8)
+-----+
!  7  !    (Box 2 contains 7)
+-----+
!  3  !    (Box 3 contains 3)
+-----+
!  1  !    (Box 4 contains 1)
+-----+
!  6  !    (Box 5 contains 6)
+-----+
```

Figure 1.

When an array is first DIMensioned (more on this later), it has nothing stored in the boxes. Most Basics automatically initialize the boxes to 0, but if there is any doubt, it's good practice to initialize them as part of the program. There are many ways to put values in the boxes.

First, they can be "stuffed" in by direct assignment statements. To do this, we must know the name of the array. Let's call it array A. The boxes have numbers automatically, numbering from A(1) to A(N), where N is the number of the bottom box. In our example, the boxes (called elements) are numbered from 1 to 5. To specify the array and box to be "stuffed," we use the following format:

```
ARRAYNAME(ELEMENTNUMBER)
```

For example, in our example, if we want to put 100 into box 3, we can do it like this:

```
A(3)=100
```

In typical Basic manner, we can use a variable to represent the box, too! Since we are going to get used to using the word "element" instead of box, we'll choose the variablename E (for Element). Now we can do this:

```
E=3: A(E)=100
```

Once again, the value 100 has been stored in the element that is numbered A(3).

You can DIM an array for practically any number of elements, but remember that unused elements use memory, so don't get carried away!

Note to Atari users: Don't leave any spaces in array/matrix variables, or you just might "crash" the system. Specifically, don't *ever* type A (E)! You can confuse Atari Basic very badly this way, and it may go away and sulk, leaving you with no way to reestablish communication except by pressing RESET and losing your program. This may not be a problem with newer Atari systems.

The wheels are going around in the mind, and the question is about to be asked: Why should I use a variable to stand for the element number? Well, you don't need to do this to assign values to elements directly, but what if you want to READ out of the DATA statement into your array? Here's how this is done:

```
10 REM STUFF ARRAY A FROM DATA
   STATEMENT
20 DIM A(10)
30 FOR E = 1 TO 5
40 READ A(E)
50 NEXT E
60 DATA 8,7,3,1,6
```

This little routine reads the values from your data statement (line 60) and stuffs them in sequence into the array. Note the DIM statement in line 20. This just reserves memory space for a ten-element array. You can DIM an array for practically any number of elements, but remember that unused elements use memory, so don't get carried away! Note, too, that many systems allow you a ten-element array without a DIM statement (TRS-80 and Applesoft Basics do this), while others require a DIM statement for all arrays (Atari does this). The word DIM stands for DIMension.

Another Atari-specific note: Atari Basic does not allow you to READ directly out of a DATA statement into an array, and you must use a normal variable in the READ statement, then do an assignment from the normal variable to the array element.

In Atari Basic, you would add line 35 READ X, then change line 40 to read

```
40 A(E)=X
```

The rest of the program is the same.

Now we know how to loop using FOR NEXT until our array is full. But what happens if there are ten elements in the array and only six numbers in the DATA statement? We get an OUT OF DATA error message. What can we do to prevent this? The easiest and most widely used method is to place an end-of-data marker as the last piece of data in the DATA statement. A number—selected so that it would not otherwise appear in the data statement—is used for this purpose. A good example might be 10000. Listing 1 is a typical routine that uses this technique.

```
10 REM EXAMPLE OF END MARKER
20 E=0
30 E=E+1
40 READ A(E)
50 IF A(E)=10000 THEN A(E)=0:GOTO
   100
60 GOTO 30
70 DATA 8,7,3,1,6,10000
100 REM REST OF PROGRAM CONTINUES
110
.
.
.
```

Listing 1.

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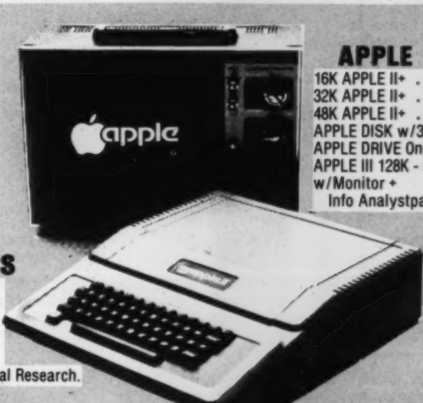

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Big Bad Matrix, continued...

Another way to load an array is by use of the INPUT statement. This allows you to put numbers directly into the array from the keyboard. To do this, simply substitute for line 40:

```
40 INPUT "NUMBER, PLEASE ";A(E)
        or
40 PRINT"NUMBER, PLEASE ": INPUT X
   A(E)=X

        (for Atari systems)
```

When all your numbers are in, you can enter 10000, and the program will jump out of the loop and proceed from line 100.

Before we leave the array and start talking about the matrix, there are a couple more things you should know. In most Basics (Atari's is the notable exception), you can store strings in the elements as well as numbers. But you can't put strings in a numeric array. You must DIM the array as follows:

```
DIM A$(10)
```

Now, anything you put into any of the elements of array A$ (pronounced "A dollar" or "A string") will be stored that way, so you can't put numbers into a string array and expect to do calculations with them! Of course you can use VAL to convert numbers stored as strings to pure numbers.

```
10  REM  ***** ALPHABETICAL SORT
     *****
20  REM  *** HOUSEKEEPING ***
30  DIM A$(10): REM  * DIMENSION
     STRING ARRAY TO HOLD UP TO 1
     1 STRINGS *
40  HOME
100  REM  *** LOAD STRING ARRAY A
     $ FROM CONTENTS OF DATA STAT
     EMENT AT LINE 150 ***
110  FOR E = 1 TO 6: REM  * NOTE
     THERE ARE 6 ITEMS IN THE DAT
     A STATEMENT *
120  READ A$(E): REM  * PUT DATA
     ITEMS INTO ARRAY ELEMENTS *
130  NEXT E
150  DATA  CAN,ARRAYS,NUMBER OR W
     ORD,DO,TASKS!,SORTING
200  REM  *** SORT ARRAY A$ USING
      ASCII VALUES REPRESENTING F
     IRST LETTER OF EACH ITEM IN
     THE ARRAY ***
210  FOR I = 1 TO 6: FOR E = 1 TO
     5
220  IF  ASC (A$(E)) >  ASC (A$(E
      + 1)) THEN  GOSUB 1000: REM
      * TO SWAP SUBROUTINE *
230  NEXT E
240  NEXT I
300  REM  *** PRINT OUT SORTED AR
     RAY ***
310  HOME
320  FOR E = 1 TO 7
330  PRINT A$(E);" ";
340  NEXT E
999  END
1000  REM  *** SWAP CONTENTS OF T
     WO ELEMENTS ***
1010 TE$ = A$(E)
1020 A$(E) = A$(E + 1)
1030 A$(E + 1) = TE$
1040  RETURN
1050  END

]RUN
ARRAYS CAN DO NUMBER OR WORD
SORTING TASKS!
```

Listing 2.

An excellent example of string array use is when you want to sort a bunch of words in (for example) alphabetical order. See Listing 2 for an example of this.

The DIM Statement

Now let's take a quick look at the DIM statement. This should go toward the beginning of your program, certainly before the array is used. Remember, too, that more than one DIM for the same array name is illegal. Your program will be interrupted by a rude error message if you use a GOTO to send the program back to a line before the original DIM statement! So get the DIM out of the way at the beginning of the program, then don't let the program loop back to a line lower than the DIM line number!

Any time you want to enter a significant number of words, sentences, or numbers using INPUT or want to READ them from disk or DATA statement, use an array!

In Atari Basic, all arrays *must* be DIMmed. Applesoft and Radio Shack Basics give you the first ten (or so) elements "free." But it's a good idea to get in the habit of DIMming all arrays (and matrices), just in case you want to use an Atari system for more than Star Raiders!

In summary, any time you want to enter a significant number of words, sentences, or numbers using INPUT or want to READ them from disk or DATA statement, use an array! When you are done, you can print out the list with the program in Listing 3.

```
200 REM PRINT CONTENTS OF ARRAY A
210 E=0
220 E=E+1
230 IF A(E)=10000 THEN 300
240 PRINT A(E)
250 GOTO 220
300 REM PROGRAM CONTINUES...
```

Listing 3.

Matrices

Now bring on those big, bad matrices! No, a matrix isn't something you sleep on (nor is array some kind of disk-shaped fish): A matrix is an array with more than

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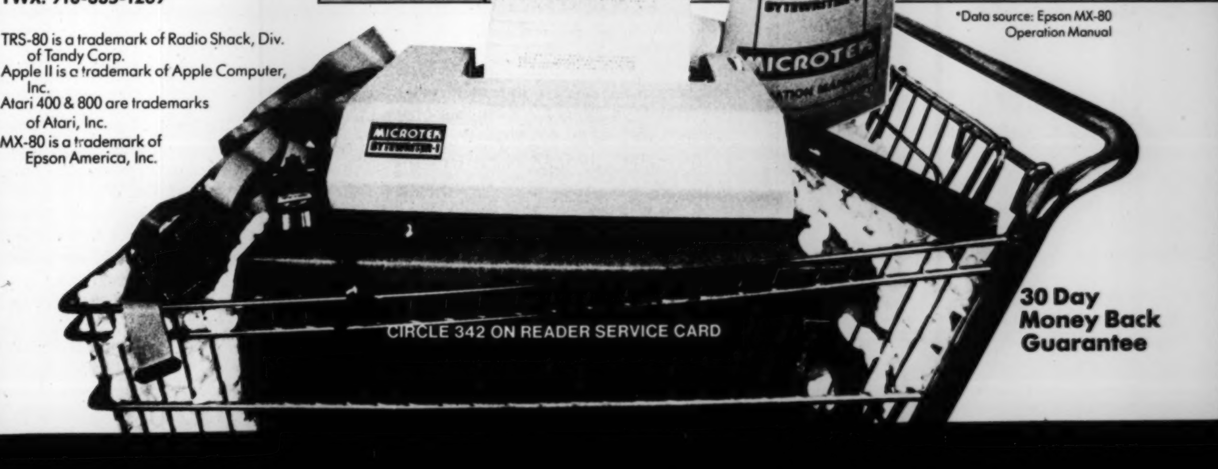

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Big Bad Matrix, continued...

one dimension! Remember we said an array is "one dimensional" because it has only height, and no width or depth? A matrix has more than one dimension, (usually two, but three- and even four-dimensional matrices are not really unusual.)

To keep it simple we'll discuss two-dimensional matrices in this article. Think of a matrix as several arrays, all of the same length (height) set side by side. The result is often called a "table," but computer people say matrix. There's one in Figure 2.

```
             MATRIX M

       Col.1 Col.2 Col.3 Col.4
      +-----+-----+-----+-----+
 Row 1! 45  !  20 !  65 !  25 !
      +-----+-----+-----+-----+
Row 2! 30  !  10 !  40 !  20 !
      +-----+-----+-----+-----+
Row 3! 105 ! 200 ! 305 ! -95 !
      +-----+-----+-----+-----+
Row 4! 300 !  50 ! 350 ! 250 !
      +-----+-----+-----+-----+
Row 5! 75  !  30 ! 105 !  45 !
      +-----+-----+-----+-----+
```

Figure 2.

Anything true of an array is essentially true of a matrix, too. You can assign both Row and Column numbers to variables. The DIM procedure is similar but not identical. The following is a correct DIM statement for our example matrix that has five rows and four columns:

```
DIM M(5,4)
```

Notice that the number of rows to be used is always the first number in the parentheses. It is followed *immediately*, without so much as a space, (especially if you are working with an Atari system) by a comma, and then immediately by the number of columns you want to DIM. Remember that the rows are horizontal and the columns are vertical. The DIM statement takes the following form:

```
DIM MATRIXNAME(ROW, COLUMN)
```

For convenience, we'll use these matrix variables: R is the Row variable, and C is the Column variable. Let's assume we want to load the matrix we have created with DIM M(5,4) statement above, and we want to use the values shown in the earlier example. What should the DATA statement look like, and how can we READ into such a matrix?

The easiest way is to use two nested FOR NEXT or other loops, one to handle the columns, and the other for the rows. Let's assume that we want to load the matrix horizontally. That is, the first four numbers in the DATA statement will go into Row 1, columns 1,2,3,4 in that order. Listing 4 shows how to do this.

```
10 REM STUFF MATRIX FM DATA STMT
20 R=1
30 FOR C=1 TO 4
40 READ M(R,C)
50 NEXT C
60 DATA 45,20,65,25,30,10,40,20,
   105,200,305,-95,300,50,350,250
   75,30,105,45
```

Listing 4.

When we RUN this program, the first four numbers in the DATA statement will be stuffed into the first horizontal row of the matrix. Now we need to add an outer loop that will cycle through the Row values, 1 to 5. Listing 5 is the same program with the two loops, properly nested.

```
10 REM STUFF MATRIX FM DATA STMT
20 FOR R=1 TO 5
30 FOR C=1 TO 4
40 READ M(R,C)
50 NEXT C
60 NEXT R
70 DATA 45,20,65,25,30,10,40,20
80 DATA 105,200,305,-95
90 DATA 300,50,350,250,75,30
100 DATA 105,45
```

Listing 5.

RUNning this program will load the matrix with the values shown in the example. To print it on the screen, try Listing 6.

```
200 REM PRINT MATRIX CONTENTS
210 FOR R=1 TO 5
220 FOR C=1 TO 4
230 PRINT R;" ";C;" ";"STORES ";
    M(R,C)
240 NEXT C
250 NEXT R
```

Listing 6.

You can "format" the print-out to fit your particular system...

Here are a few ideas for programming using matrices:

- Look-up tables.
- Storing numbers or strings for later use (remember, no strings with Atari!).
- Mathematical manipulations such as adding the first column to the second column and putting the sum in the third column.
- Multiplying a whole potful of numbers by another number.
- Storing files as a table.

For example you could write a checkbook balancer that stores old balance in column 1, check or deposit in column two, new balance in column 3, date in column 4, and check number in column 5. Or you could store data on people: name in the first column, address in column two, phone in column 3, etc.

Assuming you have "loaded" a 4 column by 5 row matrix like the one described, here's how to do arithmetical manipulations of its elements.

```
    MULTIPLY COL 1 BY COL 2

    (Store product in Col 3)

300 FOR R=1 TO 5
310 M(R,3)=M(R,1)*M(R,2)
320 NEXT R
```

Notice here that only three Basic lines need to be used to multiply practically any number of elements! Division, addition, subtraction, and the various Basic functions can also be used in this manner. Here's a short routine to look up numbers in a matrix that are related to the number in column one. For example, if you store the amount of each check written in column one, and you want to print out only those checks written for a certain amount, you can do it like this.

```
400 INPUT "ENTER AMOUNT";AM
410 FOR R=1 TO 5
420 IF AM=M(R,1) THEN PRINT
    M(R,1);" ";M(R,2);" ";M(R,3);
    " ";M(R,4)
430 NEXT R
```

The program loops through the row numbers, checking column 1 in each row for equality with the number you entered as AM. When it finds a match, it prints the contents of the other columns on that row. These columns can be used for practically anything you want! In the case of string matrices, they could be addresses, phone numbers, birthdates, anything you might want to look up. In this case, column one would contain the person's name. AM would of course have to be AM$, and the matrix would have to be dimensioned as a string matrix.

By now your curiosity should have been aroused, and you should be thinking of ways to use matrices and arrays in your own programming. They are a powerful way to store data. You can READ in the data either from a DATA statement, or from disk. Disk operations are far too system-dependent to cover in a general article, but read the DOS and Basic manuals that come with your system.

Each system is different in terms of the RAM memory used to store each matrix/array element. This information is in one of the books supplied with your system. If you can't find it, you can write a Basic program that DIMs, then stuffs a matrix. By using PRINTMEM (TRS-80), PRINT FRE(0) (Atari, Apple), or the equivalent command that tells your system to print out the remaining user memory. A little experimentation will let you find out how much RAM is used each time you use these powerful features of Basic.

In closing, you should know that matrices and arrays give you one "free" element that you can use any time you DIM an array or matrix! This is row (matrices) or element (arrays) 0. For example, you can store a number like this:

```
A(0)=100
```

Or, in a matrix, you can do this:

```
M(0)=100

M(0,1)=101

M(0,2)=102

M(1,0)=103
```

and so forth.

Element 0, Row 0, and Column 0 are always there, and you should be using them if you have very limited memory available.

One of these days, someone will whisper in your ear, "Who's Afraid of the Big, Bad Matrix?" And you can confidently respond, "Not I!" ☐

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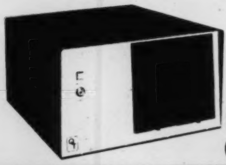

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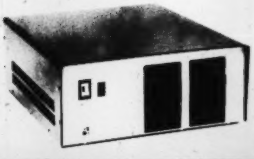

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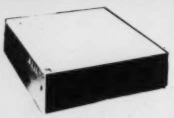

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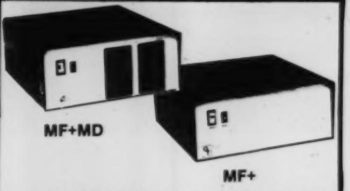

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Get Set to Tune Up your TRS-80

Howard Silver

Have you ever wondered how some TRS-80 game programs create sound effects, or how people teach their computers to play music?

Generating sounds with a computer has been the subject of recent articles in various computer journals. Most are written for the serious hobbyist with a knowledge of both hardware and software. My objective is to offer a tutorial introduction to this subject and give you some simple routines which you can run on your TRS-80, without any hardware modifications.

Your kids can have fun as well as learn from these routines, and it gives you something simple with which to impress your friends. When you get beyond this article you will undoubtedly want to consult the literature and learn how to use such hardware as digital-to-analog converters and synthesizer boards, to allow you to generate higher quality audio.

I will attempt in this article to show how simple digital tones can be generated by software and how this technique can be extended to keyboard controlled sound generation. In this way you can convert your TRS-80 keyboard into a piano-like keyboard or into a sound effects generator.

The only hardware you need is an amplifier/speaker. Radio Shack's Archer mini-amplifier with adjustable volume control goes for about $12, and will do just fine for this purpose. All you have to do is connect the AUX jack from your tape recorder to the input of the amplifier and you're wired for sound. Don't forget, however, to reconnect the AUX jack when you want to CSAVE programs.

The easiest way to generate sound is to program your computer to output a square wave (i.e., alternating 0s and 1s) at a frequency in the audio range approximately 100-10,000 Hz). One thing I discovered quickly is that if you try to do this in Basic, the interpreter inserts far too much delay, and all you hear is low frequency "static."

You can convert your TRS-80 keyboard into a piano-like keyboard or into a sound effects generator.

In machine language, we have the opposite problem: since instructions are executed in a few microseconds, we get frequencies way above the audio range; however, we can slow things down to the desired speed by inserting some time delay into the program.

If your machine language routines are fairly short, as they are in these examples, they can be easily POKEd into memory and executed via the USR command with Level II Basic. For longer machine language programs, system programs such as EDTASM and T-Bug are handy.

To illustrate, here is a simple routine to output a square wave to the amplifier/speaker. It is written in Z-80 assembly language. (Such routines can be converted to machine code using EDTASM or by hand assembling with a Z-80 coding chart.) An advantage to assembly language or machine language programming is that you know exactly how long it takes to execute an instruction—that's important here. The cycle times are shown with the instructions in Listing 1.

The first instruction outputs the Z-80's accumulator (A) contents to Port 255 (hex FF); the TRS-80 decodes this port address

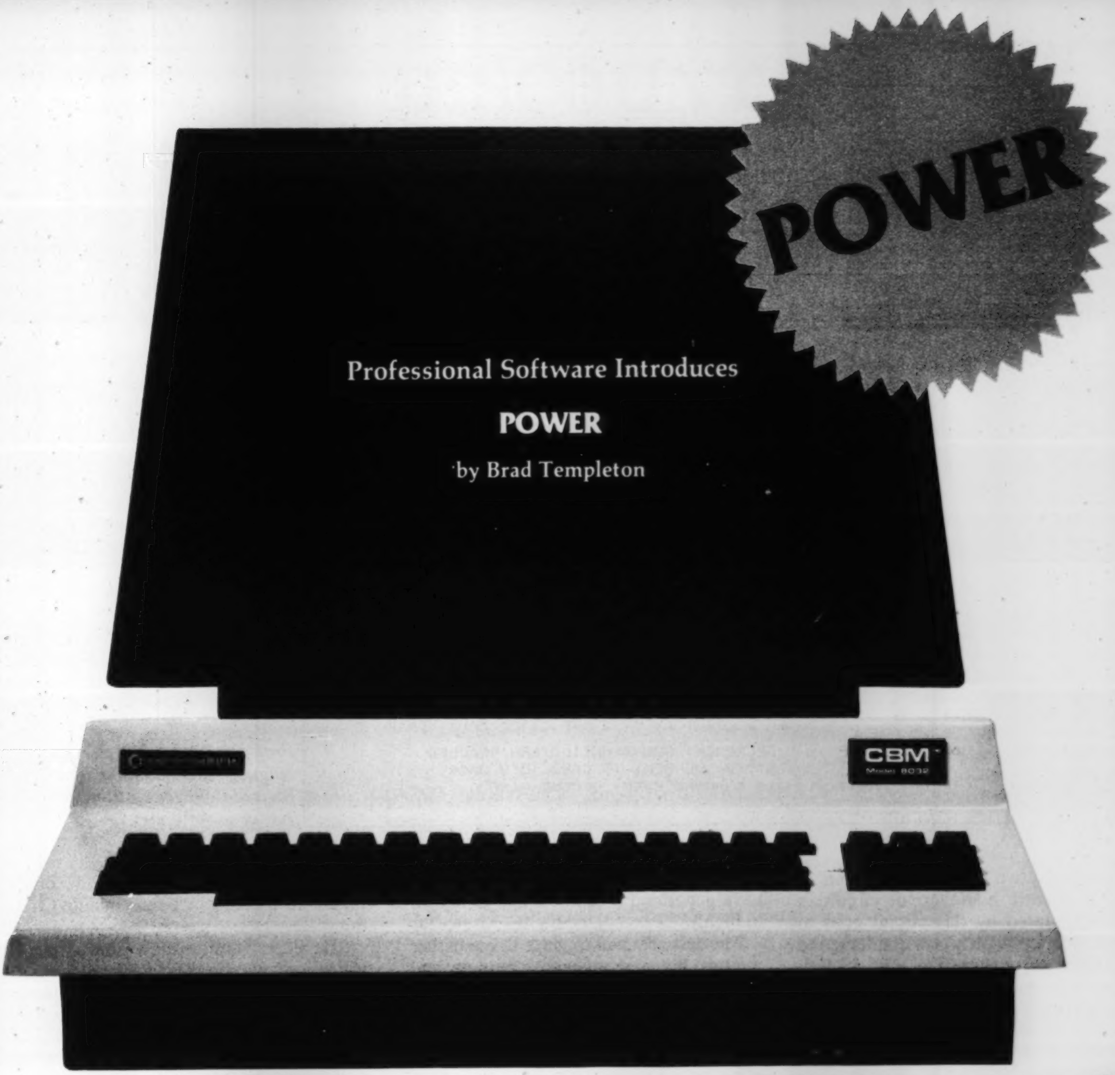
```
                              Instruction Cycle
                                    Times

NEXT    OUT     (0FFH), A          11
        LD      B, 150              7
LOOP    DJNZ    LOOP                8/13*
        INC     A                   4
        JR      NEXT               12

*8 cycles if the condition is not true,
13 if true.
```

Program Listing 1. Assembly Language Routine to Output Square Wave at Audio Frequency.

Howard Silver, 10 Clairmont Drive, Woodcliff Lake, NJ 07675.



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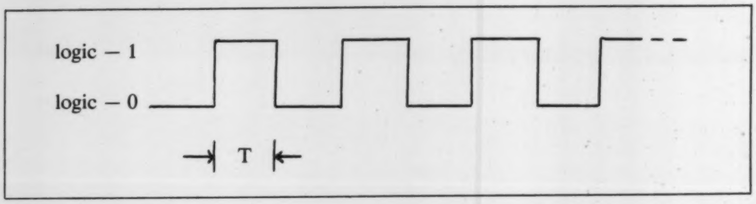

Figure 1. Square wave sent to audio output circuit.

```
5 'LOAD TONE GENERATION ROUTINE
10 POKE 16526,0 :POKE 16527,125
20 FOR X=32000 TO 32010:READ A:POKE X,A:NEXT
30 DATA 205,127,10,211,255,69,16,254,60,24,248
35 'ENTER FREQUENCY FACTOR AND CALL MACHINE LANGUAGE ROUTINE
40 INPUT N:X=USR(N)
```

Program Listing 2. Basic routine to load and execute tone generation program.

```
                    ORG  7D00H
7D00 CD7F0A         CALL 0A7FH     ;PASS BASIC ROUTINE PARAMETER TO HL
7D03 D3FF      NEXT OUT  (0FFH),A ;OUTPUT ACCUMULATOR TO CASSETE RECORDER PORT
7D05 45             LD   B,L
7D06 10FE      LOOP DJNZ LOOP      ;DECREMENT COUNT UNTIL ZERO REACHED
7D07 3C             INC  A         ;BIT VALUE SENT TO CASSETE'S JACK
7D08 18F8           JR   NEXT      ;IS CHANGED EVERY SECOND TIME
```

Program Listing 3. Assembly language and machine code for revised tone generation routine.

and sends the two least significant bits of A to a cassette audio ouput circuit; a signal generated by this circuit goes to the AUX jack, which is now connected to the amplifier/speaker. The TRS-80 Reference handbook (page 46) discusses the audio circuitry if you are interested.

Accumulator A has a random number initially, but that doesn't matter since we are alternating 0s and 1s anyway. The OUT instruction, incidentally, is equivalent to the Level II Basic instruction OUT 255,X where X can be any 8-bit number.

Register B is used as a delay counter, and the LD instruction loads it with decimal 150 initially. This number was chosen arbitrarily for illustration. The DJNZ instruction causes B to be decremented by one, and then jumps to the specified location LOOP (which is the same place) if the result is not zero. Therefore, the program will continue to execute this instruction (i.e., remain in the LOOP) until the count reaches zero. For our illustration DJNZ is executed 150 times.

After exiting the loop, INC A results in incrementing A by one; the least significant bit is always complemented by this operation and the next bit is complemented every second time. This gives us the pattern of alternating 0s and 1s.

The last instruction, JR, returns us to the first instruction and causes the new bit value to be outputted. We, therefore, have generated a square wave as shown in Figure 1.

The delay counter (register B) establishes the time between successive outputs, and thus the frequency of the square wave.

From what I can gather from the description of the audio output circuit in the Reference Handbook, an approximation of a sine wave is generated at a frequency corresponding to the square wave frequency of the *next to least* significant bit. This frequency is then

$$f = 1/2\,(\frac{1}{2T})$$

where T is the time between successive OUT instructions in the assembly language program. Since the DJNZ instruction is repeated 150 times (the initial value placed in the B register counter), the total number of cycles works out to

$$\underbrace{11}_{\text{OUT}} + \underbrace{7}_{\text{LD}} + \underbrace{13(150\text{-}1) + 8}_{\text{DNJZ}} + \underbrace{4}_{\text{INC}} + \underbrace{12}_{\text{JR}} = 1979$$

The TRS-80 clock runs at a rate of 1.774 MHz, so that T is then

$$\frac{1979}{1.774} = 1116 \text{ microseconds}$$

and the frequency of our tone should be

$$\frac{10^6}{4(1116)} = 224 \text{ Hz.}$$

For those musically inclined, this corresponds to the note A below middle C on the scale.

The Basic routine shown in Listing 2 will allow you to POKE the machine code for the tone generation program discussed. A modification was made to allow us to select the tone frequency by inputting an 8-bit number, which is then passed along to the machine language.

Lines 10 and 20 insert the coded machine language instructions (data on line 30). Line 40 allows us to input a variable N (N should be an integer from 1 to 255), and X = USR(N) calls the machine language routine. The corresponding machine code is shown in Listing 3.

Listing 3 has added one line to Listing 1 and changed another. The instruction CALL 0A7FH branches to a subroutine stored in the Level II Basic interpreter. This subroutine loads the value of N specified by the USR command into the 16-bit register paid HL. Since N is only an 8-bit number here, it appears in the 8-bit L register. The instruction LD B,L then moves N from L to B in preparation for the decrement and jump operation (DJNZ). LD B,L takes four clock cycles.

The total cycles are calculated as previously:

$$11 + 4 + 13(N\text{-}1) + 8 + 4 + 12 = 13N + 26 = 13(N+2)$$

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```
10 DEFINT A-Z
15 'LOAD  KEYBOARD CONTROLLED TONE ROUTINE
20 POKE 16526,0 :POKE 16527,125
30 FOR X=32000 TO 32023 :READ A :POKE X,A :NEXT
40 DATA 205,127,10,14,255,221,33,255,56,237,89,
69,16,254,28,203,155,175,221,190,0,200,24,241
45 'WAIT FOR KEY TO BE PRESSED
50 K$=INKEY$
60 IF K$="" THEN 50
65 'SEND CHARACTER CODE TO MACHINE LANGUAGE ROUTINE
70 N=ASC(K$)
80 X=USR(N)
90 GO TO 50
```

Program Listing 4. Basic routine for keyboard controlled tones.

```
                    ORG   7D00H
7D00 CD7F0A         CALL  0A7FH
7D03 0EFF           LD    C,0FFH
7D05 DD21FF38       LD    IX,38FFH ;ADDRESS FOR SENSING ANY KEY DOWN
7D09 ED59      NEXT OUT   (C),E    ;OUTPUT INDIRECTLY TO CASSETTE RECORDER PORT
7D0B 45             LD    B,L
7D0C 10FE      LOOP DJNZ  LOOP
7D0E 1C             INC   E
7D0F CB9B           RES   3,E      ;MAINTAIN NORMAL SIZE CHARACTER DISPLAY
7D11 AF             XOR   A
7D12 DDBE00         CP    (IX+0)   ;RETURN TO BASIC ROUTINE
7D15 CA             RET   Z        ;ONLY WHEN KEY RELEASED
7D16 18F3           JR    NEXT
```

Program Listing 5. Assembly language and machine code for keyboard routine.

and the tone frequency is

$$\frac{1.744 \times 10^6}{4 \times 13(N+2)} = \frac{34100}{N+2} \quad \text{Hz}$$

where N ranges from 1 to 255. Table 1 illustrates the fact that a variable 8-bit delay factor N allows us to produce tones which span the audio range.

N	f	
225	133 Hz	(lower C on music scale)
200	169	
100	335	
50	656	
20	1550	
10	2840	
5	4870	
2	8530	
1	11370	

Table 1. Audio Frequencies generated from values of Delay Factor N.

Incidentally, since the machine language routine loops endlessly, you can exit it only by pressing the Reset button (the Break key only gets you out of a Basic routine).

The revised tone generating routine allows us to input a number which, in effect, selects the tone frequency or pitch. However, we must stop and restart the program every time we want to change the pitch.

How about controlling the pitch from the keyboard while the program is running? That's easy to do, and it gives us something very useful—a "piano-like" TRS-80 keyboard. A Basic routine which produces keyboard controlled tones is shown in Listing 4; the assembly instructions and machine code are given in Listing 5.

Listings 4 and 5 illustrate the usefulness of linking the Basic and machine language routines. That part of the program which waits for a key to be pressed can be written in Basic since time is not critical. Once a key is pressed, the machine language code issues the tone and also checks the key to insure that it has remained down. When the key is released, control returns to our Basic routine and silence reigns until we press the next key.

To make the keyboard really "piano-like" requires a scheme whereby the ASCII codes are converted to a number relating to the physical position of the key.

From the Basic listing, we see that lines 20-40 load in the machine code and the program loops between 50 and 60 until any key is pressed. Line 70 returns the ASCII code of the corresponding key as N and line 80 calls the machine language routine, again passing to it the parameter N.

After loading register L with N by calling the subroutine at hex address 0A7F, the C-register is loaded with the device address 255 and a 16-bit index register, IX, with the keyboard address hex 38FF.

The OUT(C),E instruction outputs the number in E to the device whose address is stored in C. Register E is being used to output the alternating 1s and 0s. The accumulator A, used for this purpose in our previous programs has another function here.

The instruction RES3,E (reset bit 3 of E) is an optional one which I threw in after noticing that the video screen alternated between normal size and double size character width while the program was running. The hardware diagrams show that bit 3 of the word being outputted controls the character size mode select; by resetting bit 3 after incrementing the 8-bit number we keep the screen in the normal size character mode. This is advantageous if you wish to add software to display information while the tones are sounding.

The program segment

```
XOR     A
CP      (IX+0)
RET     Z
```

returns control to the Basic routine if the number found in the keyboard address hex 38FF is zero. The keyboard hardware (again see the TRS-80 Reference Handbook) will return zero to this address only when no key is down; hence, this is an easy way to sense the release of a key. If the key is still down, we remain in the machine language program, jump back to NEXT, and continue to output 1s and 0s.

The timing analysis is similar to that for the previous programs; for large enough N most of the time is spent executing DJNZ LOOP, at 13 cycles per instruction. When this program is run, we get a different tone for each key pressed—in fact we can also use the Shift key in conjunction with the other keys to give us twice the number of different frequencies. The Shift

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key does not affect the printing of alphabetic characters since they all print as upper case regardless; however, different ASCII codes are returned depending on whether Shift is down along with the other key. All keys, except Break, can be used here (including Enter and the space bar).

At this point there is one problem. The ASCII codes are rather unrelated to the physical position of the keys on the keyboard. To make the keyboard really "piano-like" requires a scheme whereby the ASCII codes are converted to a number relating to the physical position of the key. Then we can get a uniform increase (or decrease) in tone frequency as we hit keys in successive positions—as on a piano of course. The routine in Listing 6 accomplishes this. The assembly language routine is the same one used in Listing 5.

The ASCII-code-to-key-position conversion is done by defining an array B(I), where I is the ASCII code and the value of B(I) is the physical position of the corresponding key (lowest position number in upper left of keyboard and highest in lower right. For this example only the lower case characters are used (i.e. Shift key should not be held down): The ASCII codes are 8, 9, 10, 13, 31, 44 to 59, and 64 to 91—a total of 49 keys excluding Break.

The data on line 80 identifies the position from 1 to 49 in order of ascending numerical ASCII code. Lines 50 to 70 of the program assign these position values to the array and line 110 converts the ASCII code Y of the key pressed to its position Z.

Line 120 then converts the position number to the 8-bit delay factor N, which ranges from 245 for key 1 down to 5 for key 49. Since the larger the delay, the lower the frequency, we have the tone frequencies increasing in steps from the upper left to the lower right on the keyboard. As in our previous routine, we then pass N to the machine language routine and return to Basic only when the key is released.

```
                               ORG   7D00H
7D00 CD7F0A                    CALL  0A7FH
7D03 0EFF                      LD    C,0FFH
7D05 DD21FF38                  LD    IX,38FFH
7D09 3E01         START        LD    A,1       ;START WITH HIGHEST FREQUENCY
7D0B 55           DURATION     LD    D,L       ;LOAD TONE DURATION FACTOR
7D0C 47           BITCMPL      LD    B,A
7D0D ED59                      OUT   (C),E
7D0F 1C                        INC   E
7D10 CB9B                      RES   3,E
7D12 10FE         BITVAL       DJNZ  BITVAL
7D14 15                        DEC   D
7D15 20F5                      JRNZ  BITCMPL
7D17 3C                        INC   A         ;DECREASE TONE FREQUENCY
7D18 BC                        CP    H         ;REPEAT UNTIL LOWEST
7D19 20F0                      JRNZ  DURATION  ;FREQUENCY IS REACHED
7D1B AF                        XOR   A
7D1C DDBE00                    CP    (IX+0)
7D1F C8                        RET   Z
7D20 18E7                      JR    START     ;REPEAT SEQUENCE IF KEY HELD DOWN
```

Program Listing 7. Assembly language and machine code for sound effects generation.

Note that line 120 can be changed to suit one's needs. One useful variation for budding music composers is to choose values of N corresponding to notes on the scale—this is probably best done using another number conversion data table. One idea which I will leave for you to pursue, is to use alphabetic keys such as A, B, C, . . . G to generate corresponding notes on the music scale. The shift key can then be used to take you up or down one octave. Note that the array B(I) was dimensioned to 128 in line 10 of the program, allowing for use of upper case ASCII character codes.

As a parting shot, here is a suggested modification of Listing 6 that will give you a rather startling array of keyboard generated sound effects:

```
30 FOR X=32000 TO 32033:READ
   A: POKE X,A:NEXT X
40 DATA 205,127,10,14,255,221,33,255,
   56,62,1,85,71,237,89,28,203,155,16,
   254,21,32,245,60,188,32,240,175,221,
   190,0,200,24,231
120 M=INT (ABS ( (Z-2) /8)) :N=256*2
    ↑(M+1)+2↑ (Z-8*M)
```

The revised assembly language routine and machine code is shown in Listing 7.

Upon pressing a key, this routine does not merely issue a single frequency, but rather a sequence of tones decreasing monotonically in frequency. The number of cycles of each tone (i.e. its duration) and the number of tones in the sequence are variables dependent on the particular key pressed.

As done previously, line 110 of the Basic routine returns a number Z identifying the physical position of the key pressed. Line 120 calculates a 16-bit number, N, to be pressed to the machine language routine. The lower 8-bits, sent to register L, control the tone duration; the high 8-bits, passed on to register H hold the number of tones in the sequence. The sequence repeats itself over and over so long as the key is held down.

The calculation of N in line 120 insures a wide range of values; as a result, you will be amazed at the variety of sound effects generated by the same routine as different keys are hit. When the duration is relatively long, you will hear the notes distinctly, as if you swept your fingers across a piano keyboard. If the duration is shorter, the tones run together, resulting in bird-chirps, machine-gun, and phaser-like sounds. I'll leave it to you to figure out how the assembly language routine accomplishes all this.

If the examples presented in this article have whetted your appetite, a natural next step would be to write a routine to play a song, where notes have been stored as numbers in memory. If you do try this, one thing to remember is that the duration of each note should not be dependent on its frequency. The sound effects routine just discussed doesn't meet the criterion, since lower notes will last longer than higher notes. Hopefully, I've given you enough to tackle that and other interesting experiments. ☐

```
10 DEFINT A-Z: DIM B(128)
15 'LOAD PIANO KEYBOARD ROUTINE
20 POKE 16526,0: POKE 16527,125
30 FOR X=32000 TO 32023: READ A: POKE X,A :NEXT X
40 DATA 205,127,10,14,255,221,33,255,56,237,89,
69,16,254,28,203,155,175,221,190,0,200,24,241
45 'CONVERT CHARACTER CODE TO KEY POSITION
50 READ B(8),B(9),B(10),B(13),B(31)
60 FOR I=44 TO 59: READ B(I): NEXT I
70 FOR I=64 TO 91: READ B(I) : NEXT I
80 DATA 25,26,27,38,39,47,12,48,49,10,1,2,3,4,5,
6,7,8,9,11,37,24,28,44,42,30,16,31,32,33,21,34,35,36,
46,45,22,23,14,17,29,18,20,43,15,41,19,40,13
85 'WAIT FOR KEY TO BE PRESSED
90 K$=INKEY$
100 IF K$="" THEN 90
105 'CONVERT KEY POSITION TO FREQUENCY FACTOR AND SEND
 TO MACHINE LANGUAGE ROUTINE
110 Y=ASC(K$): Z=B(Y)
120 N=250-5*Z
130 X=USR(N)
140 GOTO 90
```

Program Listing 6. Basic routine for "piano-like" keyboard.

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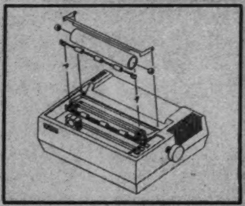

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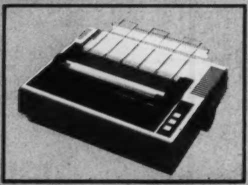

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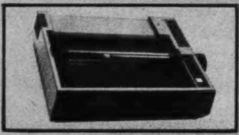

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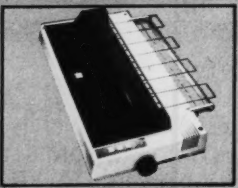

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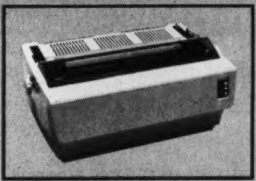

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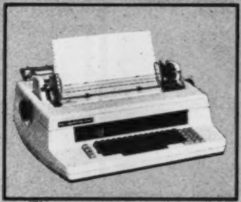

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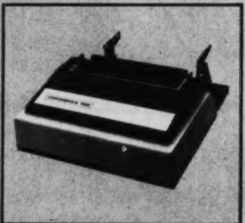

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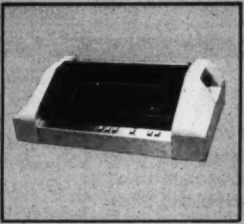

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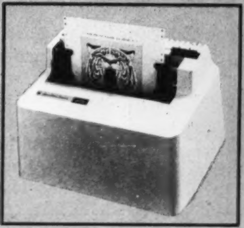

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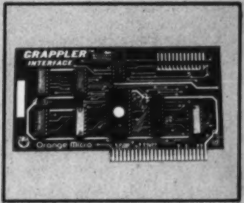

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Recursive Programming in Basic in Basic in Basic in Basic

Antonio Leal

To many personal computer users, the notion of "recursive" programs is an elusive topic usually thought of as belonging to advanced computer science and higher-level programming languages. While Basic was not designed to support recursive subroutines, they can be implemented with a small amount of bookkeeping, and their use is well worth the effort. A great deal of time can be saved in coding complex programs. However, a thorough understanding of the nature of recursion is necessary first.

The following article describes some of the important concepts in recursive programming and show how they can be used. The examples show how to program recursively in Basic. Finally, recursive programs are applied to searching game trees. First, however, some background information about functions in general will be helpful.

Functions

The concept of a "function" is fundamental to mathematics and computer science. In programming terms, a function is just a subroutine. However, it has more structure than a subroutine in Basic does. It consists of a function name, a number of input variables called "arguments" or "parameters," a body of program code, and an output quantity called the "function value." Here is an example of a function written in mathematical form.

$$f(x,y) = x^2 + y^2$$

```
┌ SUBROUTINE F(X,Y)   Subroutine name
│   ■■■■■■■■■■■■■     and arguments
│   ■■■■■■■■■■■■■
│   ■■■■■■■■■■■■■     Code
│   ■■■■■■■■■■■■■
└ RETURN              Return
```

Figure 1.

The letter f is the function name. The variables x and y are the arguments. In order to use the function, numbers are substituted for the arguments x and y and, after computation the result (value) is returned through the name. For example, if we let x=3 and y=4, the result is 25. In other words, f(3,4) returns 25 as the value of f.

One nice property of names assigned to functions is that they can be used directly in other program expressions. For example, suppose that the above function was part of a program. Then, if we wrote:

$b = 2 + f(3,4)$

the value of the function (25) would be added to 2 resulting in the assignment of 27 to b. Thus, when functions are given names, they may be activated simply by using the name rather than saying GOSUB.

A function can also be written in subroutine form. The following example is not in any particular programming language, but is generally accepted in most procedural languages such as Pascal. See Figure 1.

The subroutine may, of course, be placed anywhere within the main program and is activated by using its name.

A very important concept related to functions is the "scope" of the variables. The variables specified as arguments (the X and the Y in the example above) are always *local* to the subroutine and lose

```
┌── MAIN PROGRAM
│
│     ■■■■■■■■■■■■■
│     ■■■■■■■■■■■■■
│
│   X=3    (global X)              Main Program Code
│
│     ■■■■■■■■■■■■■
│     ■■■■■■■■■■■■■
│     ■■■■■■■■■■■■■
│
│  ┌ SUBROUTINE S(X)
│  │  ■■■■■■■■■■■■■
│  │  ■■■■■■■■■■■■■
│  │  ■■■■■■■■■■■■■                Subroutine Code
│  │
│  │   X=4   (local X)
│  │
│  │  ■■■■■■■■■■■■■
│  │  ■■■■■■■■■■■■■
│  └   RETURN
│
│     ■■■■■■■■■■■■■                Main Program Code
│     ■■■■■■■■■■■■■
│     ■■■■■■■■■■■■■
│
└── END
```

Figure 2.

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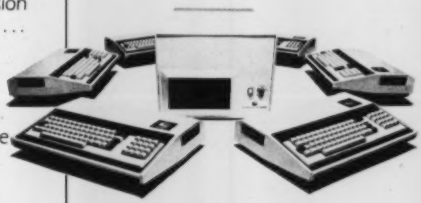

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their meaning outside of it. For example, consider the program skeleton in Figure 2.

In Figure 2, the variable X used in the main program is not the same as the X used inside the subroutine. When the subroutine is activated, the main program (global) X is saved and a new (local) X is created for use inside the subroutine. When control is returned to the main program, the old global X again becomes active and *retains* its original value. Thus, in the example above, X would have a value of 3 after exit from the subroutine even though the local X was set to 4 inside the subroutine. This "shielding" happens to all variables specified as subroutine (function) arguments.

The scope of variables suggests the notion of program "environment," which is simply a list of all variables that are currently visible and can be used or changed. As execution jumps in and out of subroutines, the environment changes accordingly, with all bookkeeping done by the computer system.

Recursive Functions

A recursive function (subroutine) is one that uses itself in its own definition. Recursive definitions are very convenient for describing certain types of mathematical formulas and, as we shall see later, for programming complex problems. For example, factorial can be described in both recursive and non-recursive form. The straight-forward definition of factorial is the following.

$$x! = (1)(2)(3)(4)......(x)$$

In other words, x! is the product of all of the integers from 1 to x, assuming the x, itself, is a positive integer. The recursive definition of x! looks like this.

$$x! = (x)(x\text{-}1)!$$

This definition uses factorial in defining it. It says that if you want to know what x! is, just multiply x by x-1 factorial. Of course, you cannot compute the result until you know what (x-1)! is, so the computation will have to wait. To get (x-1)!, we can use the definition again. (x-1)! is simply (x-1) times (x-2)!, etc. You can easily see that this type of definition is not good unless there is some way of stopping it. Every recursive function must have a "stopping rule." The rule is simply the initial value for x=1. The complete recursive definition must include the initial values.

$$1! = 1$$
$$x! = (x)(x\text{-}1)!$$

Now we know that when the iteration (recursion) reaches 1, the result is 1 and the recursion stops. This allows it to "unwind" and all of the waiting calculations can be made. Figure 3 shows the procedure for 5!

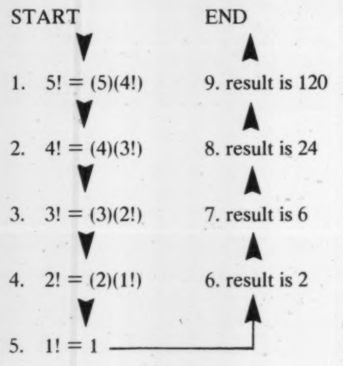

Figure 3.

A program or subroutine for factorial would have to call itself within its own program body. That is, inside the subroutine would be a use of its own name. However, before this call can be made, a test is required to see if the ending condition (stopping rule) has been met. See Figure 4.

```
SUBROUTINE F(X)

     1. IF X=1 THEN RETURN 1

     2. ELSE RETURN X*F(X-1)

END
```

Figure 4.

Again, the above form is meant to be an outline of how the subroutine would look and is not part of any particular programming language. Notice that F itself was used in line 2. For an initial call of F(5), that is, 5!, the subroutine would call itself 4 times. The recursion would be 4 levels deep. Each call would automatically set up a new environment in which the local X is different from previous calls. Thus, they do not get mixed up. Finally, on the last call, when X=1, the stopping condition is satisfied in line 1 and a 1 is returned as a result. At this point, all of the subroutine "returns" occur, and the waiting computations are made up the line until the subroutine exits for the last time with the answer to 5!

Some recursive functions depend upon more than just the previous value of the argument. For example, the Fibonacci sequence depends on the previous two values. Thus, two initial values must be specified when giving the recursive definition.

$$f(1) = 1$$
$$f(2) = 1$$
$$f(x) = f(x\text{-}1) + f(x\text{-}2)$$

This definition says that the value of the function is the sum of the previous two values and leads to the following sequence.

x:	1	2	3	4	5	6	7	8	9	....
f(x):	1	1	2	3	5	8	13	21	34	....

Recursion in Basic

There is no problem with having a subroutine call itself in Basic. The computer system will keep track of all of the return points in order, but that's all it will do. Since arguments are not allowed, the environment must be explicitly created and saved by the programmer. This can be done by dimensioning *each* single variable. (Variables already in the form of arrays must have their dimensions increased by 1.) This extra dimension is required to hold all of the intermediate results of recursion and creates space for "local" variables. The elements of each dimensioned variable correspond to the depth of recursion and an index will keep track of its depth. This means that every time a subroutine call is made, the index must be decremented and, conversely, every time a return occurs, it must be incremented. When the index reaches 1, we will know that the stopping rule is to

```
MAIN PROGRAM

10 DIM F(100)                 space for intermediate results
20 F(1)=1                     initial value
30 INPUT X                    desired value for computation
40 GOSUB 100                  first subroutine call
50 PRINT F(X)                 final result
60 STOP                       end program


RECURSIVE SUBROUTINE
100 IF X=1 THEN RETURN        stopping rule
110 X=X-1                     sets up environment for next call
120 GOSUB 100                 recursive call
130 X=X+1                     restores environment for return
140 F(X)=X*F(X-1)             recursive definition
150 RETURN                    subroutine return
```

Figure 5.

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be used. Figure 5 shows how factorial would be programmed in Basic using recursion.

Suppose that a value of 5 is given to X in line 30. The first call to the subroutine occurs in line 40. In line 100, the stopping condition is tested and fails, so X is decremented (to 4) and the subroutine is called again. This time, however, the return point is line 130 and not line 50 as it was for the first call. The "loop" between lines 100 and 120 continues until X=1 when line 100 causes a return. The return is to line 130 and the subroutine begins to "unwind." The successive returns "loop" between lines 130 and 150 placing intermediate results of computation into successive F locations. When the recursion is finished (handled automatically by the system), the subroutine returns for the last time to line 50 and the final result in F(5) is printed. (To watch it run, insert 145 PRINT F(X) .)

The reason that X must be incremented in line 130 *before* the recursive definition in line 140 is that the result of computation must be placed into the next F location. If the lines were reversed, when the bottom recursive level was reached and X=1, F(X-1) would refer to F(0) which is not defined. Lines 130 and 140 could, however, be reversed if the recursive definition was changed as follows.

```
130 F(X+1)=(X+1)*F(X)
140 X=X+1
```

However, some versions of Basic do not allow computations within the parentheses if they are on the left-hand side of the equals sign. Thus, the former method is better.

Writing a program for the Fibonacci sequence is not much more complicated. The program structure is identical. However, the stopping rule in line 100 must check for X less than or equal to 2 rather than X equal to 1 because there are two initial values. See Figure 6.

```
 10 DIM F(100)
 20 F(1)=1
 30 F(2)=1
 40 INPUT X
 50 GOSUB 100
 60 PRINT F(X)
 70 STOP

100 IF X<=2 THEN RETURN
110 X=X-1
120 GOSUB 100
130 X=X+1
140 F(X)=F(X-1)+F(X-2)
150 RETURN
```

Figure 6.

Searching Game Trees

Using recursive programs to calculate simple functions like the examples above is not very practical. They can be done with short and straightforward loops which run faster, take less space, and are less complicated. However, when the task becomes complex, recursive programs can save a lot of coding time and make the program easier to debug. One of the places that recursive routines can help is in searching game trees. If you have been reading David Levy's columns on "Intelligent Games," then you have learned that computers can be programmed to play games by constructing a "tree" of board positions using the legal moves. Then, by searching the tree for good positions, the program can "look ahead" in time and base its current move on what it discovers about possible future situations.

One of the problems with game trees is that they are difficult to construct using dimensioned vectors and arrays found in common programming languages such as Basic. Each node in the tree must carry information about its depth from the root node, whether it is a MAX or a MIN node, all information describing the current board position, and its value calculated by combining the values from all of its successor nodes. Furthermore, there must be links established between each node and its predecessor as well as between each node and all of its successors. This is particularly difficult since it may not be known how many successors each node will have. Programs must be written that will access and modify this tree data structure keeping all of the connections straight and the data for each node separate from other nodes.

Recursive subroutines can eliminate the need to consider some of these problems. Using a recursive subroutine, *it is not necessary to explicitly construct and maintain a game tree data structure*. This may be a little hard to believe, but it is possible to capitalize on the way recursive subroutines behave in order to construct a tree and search it at the same time. This is accomplished as follows. Suppose that the subroutine, itself, were a node in the game tree. In this case, a tree node would be more than just a collection of data. It would be a *procedure*. The tree node could then generate successor board positions and call itself recursively on each of them. The linkage between one node and its predecessor and successors would be maintained by the computer system automatically in the form of subroutine calls and return points. All that is required is a careful construction of the subroutine so that it can handle different situations as they occur. The following program skeleton is an outline of what this type of subroutine would look like. It is not a complete program since it uses English to explain what should happen at various points. These places can be filled in and will vary depending on which game is programmed. However, the general structure will be the same for all games that can use search trees. See Figure 7.

The variable D is the recursion index and represents the current depth of the tree. B(D) is the current board position being analyzed at depth D. V(D) contains the values of the nodes, either MAX or MIN depending upon which type of node it is. This node type is kept in variable M which is set to 1 for a MAX node or to 0 for a MIN node. By writing M=1-M, the value bounces back and forth between 0 and 1. I(D) is used to count the number of successors of each node. It must be dimensioned by D to record which successor is being examined at each depth.

Line 1 is the stopping condition. If D=1, the bottom of the tree has been reached and it is time to call the heuristic function on the board position B(1). This function analyzes the board position and returns a value in V(1) which is a measure of how good it is. The higher the number, the better the position. Line 2 sets V(D) to either a very large number or to a very small number depending on whether the node is MIN or MAX. The reason for this is because comparisons will later be made in order to obtain the highest (or lowest) value of all of a node's successors. This line initializes the value.

Line 3 begins the loop which will examine all of the node's successors, one at a time, and call the recursive subroutine on each one. Notice that it is dimensioned by D so that successors of nodes at different levels in the tree do not get mixed up. Line 4 is the place where the next successor is actually generated. Since the recursion index runs downward to 1, the next successor is in D-1. If the game is complex, there may be a lot of code at this place and more than one variable may be required to hold all of the information.

The next 3 lines set up the environment, call the subroutine recursively, and restore the environment to its original form. These lines are familiar to those shown in previous examples. D lowers and raises the current depth and M reverses from MAX to MIN and vice versa.

In line 8, the value of the current node is updated. It is set to the MAX (or MIN) of its present value and that of the successor that was just analyzed. When the loop is finished, V(D) will contain the MAX (or MIN) of all of the current node's successors and will be ready to be used by its predecessor. Lines 9 and 10 complete the loop and return up one level in the tree.

The interesting feature about this program is that, at any one time during execution, only one "path" from the root exists. The program creates the tree as it is searching it, hopping up and down the branches in the form of subroutine calls and returns. There is no explicit tree data structure which must be maintained by the programmer. All of the necessary information is contained within the subroutine.

The above program is an outline of only the recursive part of the total game-playing program. There are three other major parts in addition to any graphic output, etc. They are (1) the heuristic function, (2) the next move (successor) generator, and (3) the supervisor. The heuristic function can be a subroutine called as shown in line 1 in the example above. The next-move generator can be placed directly inside the subroutine or programmed as a subroutine itself. These programs are specific to the particular game. The supervisor, however, can be outlined in general.

The supervisor starts the board in its initial position (or current position if the game is in progress) and calls the recursive subroutine once for each possible move. The move that comes back with the highest value is the one that is chosen by the computer to play. The supervisor is, essentially, the top node in the tree and, thus, is a MAX node. It must, therefore, call the recursive subroutine with a MIN in order to get it started. As long as no win or loss situations are found, the program keeps on playing moves.

This program looks remarkably like the recursive subroutine, and the two programs can be combined with a little ingenuity. Don't forget to save the node with the highest value in line 10 or it will be lost. This is not necessary in the subroutine.

Even though the above example programs are not complete and require details to be filled in, they do show the enormous power of recursive programs. With higher-level languages such as Pascal becoming popular, recursive programs will be easier to write and, as a result, will be applied in more areas. □

```
 1. IF D=1 THEN set V(1) to the value of the heuristic
        function on B(1) and RETURN

 2. Set V(D) to a very large number if M=0 (MIN) or to
        a very small number if M=1 (MAX)

 3. FOR I(D) = 1 TO the number of successors of B(D)

        4. Replace B(D-1) with the next successor of B(D)
        5. D=D-1 and M=1-M (new environment)
        6. Call the Subroutine recursively
        7. D=D+1 and M=1-M (old environment)
        8. Set V(D) to the MAX or the MIN of V(D) and
           depending on M

 9. NEXT I(D)

10. RETURN
```

Figure 7.

```
SUPERVISOR

 1. D = chosen depth of search
 2. Construct initial board position B(D)
 3. M=0 (MIN)
 4. Set V(D) to a very small number
 5. FOR I(D) = 1 to the number of successors of B(D)
        6. Replace B(D-1) with the next successor of B(D)
        7. D=D-1
        8. Call the Recursive Subroutine
        9. D=D+1
       10. Set V(D) to the MAX of V(D) and V(D-1)
11. NEXT I(D)
12. Make move with the highest V(D) and change board
    B(D)
13. IF "WIN" THEN STOP
14. Get opponent's move and change board B(D)
15. IF "LOSS" THEN STOP
16. GOTO 4
```

Figure 8.

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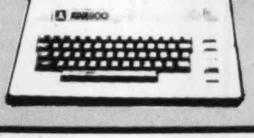

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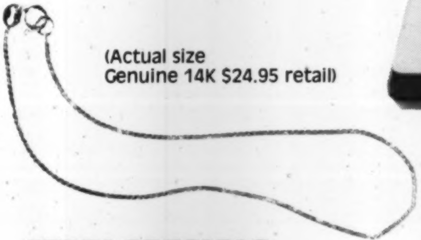

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WIZARDRY

with the System Monitor

Richard T. Simoni, Jr.

When I first purchased my Apple II two years ago and started programming in Integer Basic, I thought about a myriad of small editing features which would make my life as a programmer easier. I tried in vain to implement the features, and simply concluded, "Well, it must be beyond the capabilities of the Apple." That was before I learned some rudimentary 6502 assembly language and discovered a tricky little feature tucked into the System Monitor of the Apple.

The feature is called the "character output switch" (CSW), and is included in the Apple design to allow character output to be sent to a peripheral card PROM driver program (which might then send the output to a printer, for example). The essence of the CSW is memory locations $36 and $37, individually called CSWL (CSW Low) and CSWH (CSW High), respectively. At any one time, these locations hold the starting address of the current character output routine. When you press Reset and enter the System Monitor, this address is $FDFO, the starting address of the COUT1 routine in the Apple Monitor. This routine takes the number stored in the accumulator (A-register) and displays its ASCII equivalent on the screen at the current cursor position. Every time the Apple wants to print a character on the screen, execution branches to the address stored in the CSW.

Now the big question comes up: "How do I use these CSW locations to make my Apple do strange and wonderful things it couldn't do before?" Well, the solution is to change the address stored in the CSW from the location of the Apple's output routine to the location of your own machine language routine. After accomplishing its purpose, your routine can then jump to Apple's output routine, and you've fooled the Apple. It'll never know the difference!

```
*3EFL

03EF-   A9 00        LDA   #$00
03F1-   85 36        STA   $36
03F3-   A9 03        LDA   #$03
03F5-   85 37        STA   $37
03F7-   60           RTS
03F8-   4C EF 03     JMP   $03EF
```

Listing 1.

Of course, before writing sneaky routines that control the cursor, list programs with continuous user control over the speed of the output, etc., we must devise a method to replace the address stored in locations $36 and $37 with the address of our own routine. Since page three of memory can be used for machine language programs in both the Integer Basic and Applesoft II Basic memory map, I have chosen to start our routines at memory location $300. Our routine will then be "activated" by storing the address $300 in the CSW (locations $36 and $37). This can be accomplished in a number of ways, such as the Monitor command:

*36:00 03 (return)

I personally prefer to use the short assembly language program shown in Listing 1. This program is executed by typing the Monitor CTRL-Y command. Once this program and our routine are entered, therefore, all that is needed to "activate" the routine is:

*(CTRL-Y) (return)

This main control program can be used with each of the routines described in this article.

Stoplist

Enough of the preliminaries. Let's plunge into some actual wizardry. The first routine is named Stoplist, and is shown in Listing 2. After entering this routine along with the main control program (I will assume from here on that you have already done this), the CTRL-Y command will activate Stoplist. Try listing some memory (*000.FFF) and touch a key as the data scrolls by. The display will freeze until you press another key. The routine

Listing 2.

```
*300L

0300-   48          PHA              ;SAVE A-REG
0301-   AD 00 C0    LDA   $C000      ;WAS KEY PRESSED?
0304-   10 08       BPL   $030E      ;NO, BRANCH TO END
0306-   AD 10 C0    LDA   $C010      ;CLEAR KEYBOARD
0309-   AD 00 C0    LDA   $C000      ;WAIT UNTIL ANOTHER
030C-   10 FB       BPL   $0309      ;  KEY IS PRESSED
030E-   AD 10 C0    LDA   $C010      ;CLEAR KEYBOARD
0311-   68          PLA              ;RESTORE A-REG
0312-   4C F0 FH    JMP   $FDF0      ;SEND CHAR TO SCREEN
```

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SUBROUTINE	ADDRESS	FUNCTION
PREAD	$FB1E	lets Y-register=PDL(X-register)
ADVANCE	$FBF4	advances cursor
BS	$FC10	backspaces cursor
UP	$FC1A	moves cursor up
LF	$FC66	moves cursor down (line feed)
COUT1	$FDF0	displays ASCII character in A-register at current cursor position
IOSAVE	$FF4A	saves all registers in page zero locations
IOREST	$FF3F	restores all registers from these locations

Table 1.

NAME	LOCATION	FUNCTION
CSWL	$36	character output switch (see text)
CSWH	$37	
ACC	$45	temporary storage for the A-register
XREG	$46	temporary storage for the X-register
IN	$200	first location in the line input buffer
KBD	$C000	keyboard data entry location
KBDSTRB	$C010	clear keyboard strobe when accessed

Table 2.

```
*300L

0300-   20 4A FF    JSR   $FF4A    ;SAVE REGISTERS
0303-   A2 00       LDX   #$00
0305-   20 1E FB    JSR   $FB1E    ;LET Y-REG=PDL(0)
0308-   C0 00       CPY   #$00     ;IS Y-REG=0?
030A-   F0 0B       BEQ   $0317    ;YES, GO TO END
030C-   A2 FF       LDX   #$FF     ;NO, ENTER X-REG LOOP
030E-   CA          DEX
030F-   E0 00       CPX   #$00
0311-   D0 FB       BNE   $030E    ;END OF X-REG LOOP
0313-   88          DEY            ;Y-REG=Y-REG-1
0314-   4C 08 03    JMP   $0308    ;GO BACK TO Y-REG LOOP
0317-   20 3F FF    JSR   $FF3F    ;RESTORE REGISTERS
031A-   4C F0 FD    JMP   $FDF0    ;SEND CHAR TO SCREEN
```

Listing 3.

will remain in effect if you enter either Basic, but if you press Reset, the Apple will put its own address back in the CSW and you will have to re-activate with the CTRL-Y command.

The Stoplist routine brings up a few points which must be needed when writing routines for use with the CSW feature. You must protect the 6502 registers! Don't forget, when your routine is called, the ASCII equivalent of the letter or symbol to be displayed will be stored in the accumulator. If you want this character to make it to the screen, you must make certain the value in the accumulator is the same upon exiting your routine as it was upon entry. In the Stoplist routine, this is accomplished by pushing the A-register on to the stack (PHA instruction) at the beginning of the routine and then pulling it back (PLA instruction) before jumping to the screen output routine of the Monitor.

Stoplist is also similar to most routines using the CSW feature in that it references some hardware-dependent memory addresses and jumps to some routines in the System Monitor. The Monitor subroutines called by the programs presented in this article are listed in Table 1. Special hardware-dependent memory locations used by the programs presented in this article are listed in Table 2.

Slowlist

Let's say after using Stoplist for a while, you decide that you don't actually want to stop the listing; you just want to slow it down a bit so you can read it as it goes by. Our next routine, named Slowlist and shown in Listing 3, is for you. After keying in the routine and activating it, you will find that the speed of all screen output is governed by the position of paddle 0. This allows you to speed past the sections of the listing you don't care about, and slow down to digest the good parts.

Slowlist works by reading the paddle position (using the PREAD subroutine in the Monitor) and then creating a delay proportional to that position. After the delay, the routine sends the next character to the Monitor COUT1 routine to be displayed on the screen. Note again that Slowlist makes sure to protect the registers. Since the routine changes the X and Y registers, simply pushing the accumulator on the stack as we did in Stoplist will not protect the registers. Luckily, a simple call to the monitor IOSAVE routine stores all the registers in memory locations set aside for this purpose in page zero. When all is done and the registers must be restored, a call to IOSAVE's sister routine, IOREST, restores the registers to their original state.

Cursor Control

Often, when editing programs in either Integer Basic or Applesoft II Basic, I find myself confronted with a seemingly unending string of key sequences using the ESCape key to position the cursor just where I want it. The only problem with this is that each cursor move takes two keystrokes instead of one, not to mention that the cursor cannot be moved up or down with the Repeat key. Cursor Control, shown in Listing 4, takes care of these problems. Once activating the routine, the cursor can be controlled by holding down the CTRL key and pressing the A, B, C, or D keys to move the cursor right, left, down, or up, respectively. While this also requires two keystrokes to move the cursor a single postion, additional moves are made by continuing to hold the CTRL key down until the cursor is in the desired position on the screen. These control character movements are also compatible with the Repeat key.

While the method used by Cursor Control to accomplish its tasks is fairly straightforward, some of the instructions near the end of the routine are rather confusing. This section erases the control character typed by the user from the input line buffer. This buffer starts at location $200 and holds the ASCII value of each character typed into the input line. Although a typed control character goes into the buffer, it is not shown on the screen, and therefore would not normally have to be eliminated from the buffer. Unfortunately, any control character inserted within an Applesoft statement

```
*300LL

0300-    20 4A FF    JSR     $FF4A      ;SAVE REGISTERS
0303-    A5 45       LDA     $45        ;GET CHARACTER
0305-    C9 84       CMP     #$84       ;CTRL-D PRESSED?
0307-    D0 06       BNE     $030F      ;NO, GO TO NEXT CHECK
0309-    20 1A FC    JSR     $FC1A      ;MOVE CURSOR UP
030C-    4C 2A 03    JMP     $032A      ;END, ERASE CTRL-D
030F-    C9 83       CMP     #$83       ;CTRL-C PRESSED?
0311-    D0 06       BNE     $0319      ;NO, GO TO NEXT CHECK
0313-    20 66 FC    JSR     $FC66      ;MOVE CURSOR DOWN
0316-    4C 2A 03    JMP     $032A      ;END, ERASE CTRL-C
0319-    C9 82       CMP     #$82       ;CTRL-B PRESSED?
031B-    D0 06       BNE     $0323      ;NO, GO TO NEXT CHECK
031D-    20 10 FC    JSR     $FC10      ;MOVE CURSOR LEFT
0320-    4C 2A 03    JMP     $032A      ;END, ERASE CTRL-B
0323-    C9 81       CMP     #$81       ;CTRL-A PRESSED?
0325-    D0 17       BNE     $033E      ;NO, GO TO END
0327-    20 F4 FB    JSR     $FBF4      ;MOVE CURSOR RIGHT
032A-    AD 00 02    LDA     $0200      ;GET CHAR INPUT
032D-    C9 85       CMP     #$85       ;CTRL CHARACTER?
032F-    B0 05       BCS     $0336      ;NO, BRANCH
0331-    A9 A0       LDA     #$A0       ;REPLACE CTRL
0333-    8D 00 02    STA     $0200      ;WITH SPACE
0336-    A5 46       LDA     $46        ;GET LINE LENGTH
0338-    C9 00       CMP     #$00       ;LENGTH=0?
033A-    F0 02       BEQ     $033E      ;YES, DON'T DECREMENT
033C-    C6 46       DEC     $46        ;NO, SUBTRACT ONE
033E-    20 3F FF    JSR     $FF3F      ;RESTORE REGISTERS
0341-    4C F0 FE    JMP     $FDF0      ;SEND CHAR TO SCREEN
```

Listing 4.

```
*300L

0300-    C9 A0       CMP    #$A0     ;NON-CTRL CHAR?
0302-    B0 07       BCS    $030B    ;YES, GO TO END
0304-    C9 8D       CMP    #$8D     ;RETURN CHARACTER?
0306-    F0 03       BEQ    $030B    ;YES, GO TO END
0308-    38          SEC
0309-    E9 40       SBC    #$40     ;MAKE CTRL FLASHING CHAR
030B-    4C F0 FD    JMP    $FDF0    ;SEND CHAR TO SCREEN
```

Listing 5.

will cause a "SYNTAX ERR" message (except in a PRINT statement, of course). In order to keep the routine compatible with Applesoft (Integer Basic doesn't have this problem), I wrote Cursor Control such that all control characters were eliminated from the input buffer.

The last routine I will present here is of use primarily to Disk II owners. When I first came home with my brand new disk drive, I plugged it in and wrote a short program in Basic to save on my crisp new diskette. (Just to see if it would work.) In my excited frenzy to think of a suitable name under which to save the program, I made the irrational decision to type in quickly a random series of letters as the file name. So I had a program named "AFDYUOISIIS" on my diskette catalog. Much to my dismay, I found I couldn't reload the program or even access it in order to delete the strange name from my diskette. After repeatedly seeing the "FILE NOT FOUND" message, I realized that when I originally saved the program, I had inadvertently inserted a control character into the file name. Since control characters don't show themselves on the screen, I didn't know which character I had typed, and I didn't know where in the name I had typed it.

This horrible situation prompted me to write Ctrl-flash (shown in Listing 5), another CSW-oriented routine which displays all control characters as flashing characters on the screen. After activating the routine, try typing some control characters. They will "flash before your eyes."

The method used in Ctrl-flash is simple. If the program detects the character code in the accumulator to be a control character, the program subtracts just enough from the character's ASCII code to pull it down into the range of numbers the Apple displays as flashing letters.

I hope you will be able to use the techniques presented here to further explore some of the inner capabilities of the Apple hidden deep within its circuits. With some imagination, you should be able to write your own routines to suit your own needs. CSW routines have a habit of becoming extremely useful to the programmer who uses them! ☐

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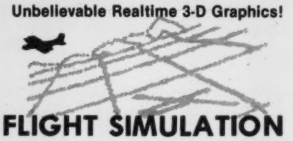

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Neaten Up Those Messy Numerical Tables

Donald J. Taylor

Displaying several columns of numerical data side by side can be a problem with the Apple II computer. A number can require as many as 15 character spaces and the standard display width is only 40 wide.

Another nuisance with columns of data is that the Apple prints the number in either fixed point or scientific notation depending on the size of the number, and it does not print trailing zeros or trailing decimal points. While this is nice for the clarity of numbers printed by themselves, it is not so nice for columns because it causes the display width to vary and messes up the alignment of decimal points and exponentials in the column. A severe case chosen to illustrate these problems is shown in Column A of Table 1 (giving values of x*(10→x) for x=-4 to 10 in steps of 0.5). Aside from neatness this variation in number format makes it harder to scan the column, and to pick optimum tab settings.

A big help in getting more columns to fit within the display is to truncate or round off digits that are not of interest and only distract the eye. The usual simple ways of doing this round or truncate to a set number of decimal places. As a result, when fixed point data ranges over more than one decade the number of significant figures in the data varies (e.g., 1.23, .12, .01). For this kind of data one would often prefer to maintain a set number of significant figures, not decimal places (1.23, .123, .0123).

Another problem one occasionally encounters with the simple roundoff methods is that the internal roundoff of the computer gives you a long string of unwanted nines, or of zeros ending in a one, after the intended roundoff place (1.22999999, or 1.23000001); defeating the intention of shortening the width and possibly causing the number to run into the next column.

The subroutine listed below solves all of these problems for the user who can use a scientific notation format. It provides a user-selected fixed number of significant figures which does not change from one decade to the next. It also converts the number to an absolutely uniform format so that the alignment of a column is perfect as shown in Column B of Table 1. Column B shows the same data as column A after conversion to scientific notation by the subroutine (with roundoff to three significant figures).

The way this routine works is by converting the number to a string which is then disassembled using the left$, mid$, and right$ functions. It is then reassembled

Table 1.

```
     SAMPLE DATA COLUMNS

  COLUMN - A        COLUMN - B
  ----------------------------
  -4E-04            -4.00E-04
  -1.10679718E-03 -1.11E-03
  -3E-03            -3.00E-03
  -7.90569415E-03 -7.91E-03
  -.02              -2.00E-02
  -.0474341649      -4.74E-02
  -.1               -1.00E-01
  -.158113883       -1.58E-01
  0                  0
  1.58113883         1.58E+00
  10                 1.00E+01
  47.4341649         4.74E+01
  200                2.00E+02
  790.569415         7.91E+02
  3000               3.00E+03
  11067.9718         1.11E+04
  40000              4.00E+04
  142302.495         1.42E+05
  500000.001         5.00E+05
  1739252.71         1.74E+06
  6000000            6.00E+06
  20554804.8         2.06E+07
  70000000           7.00E+07
  237170825          2.37E+08
  800000000          8.00E+08
  2.68793601E+09     2.69E+09
  9E+09              9.00E+09
  3.00416378E+10     3.00E+10
  1E+11              1.00E+11

A= AS THE APPLE PRINTS,
B= AS CONVERTED BY THIS
PROGRAM WITH ROUNDOFF TO 3 SIG-
NIFICANT FIGURES IN THIS CASE.
```

Donald J. Taylor, Ph.D, 8053 E. Avon Lane, Lincoln, NE 68505.

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by concatenation into a truncated string mantissa (factor that multiples the exponential), and string exponential for the scientific notation format. In the process it inserts zeros where needed so that the decimal point and exponential always appear at the same places in the string.

If the user would prefer to insert blank places instead of zeros, this can be accomplished by changing the string of zeros in line 140 to a string of blank spaces. Zeros are needed however, if the rounding routine is to be used. Aside from this, about all there is to the routine is the series of tests made before converting a number to determine which category it is in to start with—scientific notation, zero, fixed point; less than one, less than 0.1, or greater than or equal to one—since each of these categories requires a different routine.

The rounding routine works by rounding the already truncated mantissa to one less place. It does this by converting the mantissa to an integer (same digits without the decimal point) and adding five. The result of this addition is then truncated to one less place to complete the rounding. This is why the program gives "D" digits with truncating alone but only "D"-1 with rounding added. When rounding is used just set "D" to one more than the number of digits you want. The rest of the rounding routine is involved with increasing the exponential by one for the case where the leading digit is a nine that rounds to a ten.

The subroutine with truncation (but not rounding) is listed as Program 1. This program truncates the mantissa to whatever number of significant figures the user selects between 1 and 9. Its execution time is about 100 millisec. For the user who prefers roundoff to truncation, the routine listed as Program 2 can be inserted as a block in Program 1 at the place indicated by the line numbers. It will round off to whatever number of significant figures the user selects between 1 and 7. With rounding the total execution time is about 140 millisec.

Since the output results are concatenated as the last step in the routine from separate strings for the mantissa and exponential, the user can easily alter the print format by inserting spaces between mantissa and exponential, or deleting "E" or even the exponential or the mantissa.

Program 1.

```
■

100  REM  SCIENTIFIC NOTATION FORMATTER
102  REM  CONSTANT SIGNIFICANT FIGURES
104  REM  TRUNCATOR/ROUNDER
106  REM  BY DONALD J. TAYLOR
108  REM  JUNE 1,1981
110  REM  INPUTS REQUIRED X AND D
112  REM  X=INPUT #
114  REM  D=#DIGITS FOR TRUNCATION
116  REM  D-1=# DIGITS FOR ROUNDING
118  REM  X$= OUTPUT
120  REM
122 S$ = " ": IF  SGN (X) =  - 1 THEN S$ = "-"
124 X =  ABS (X):X$ =  STR$ (X):P =  LEN (X$)
126  IF P > 4 THEN  IF  MID$ (X$,P - 3,1) = "E" THEN P$ =  MID$ (X$,P - 2)
     :X$ =  LEFT$ (X$,P - 4):X$ =  LEFT$ (X$,1) + "." +  MID$ (X$,3): GOTO
     140
128  IF X = 0 THEN X$ = " 0":P$ = "": GOTO 164
130  IF X < 1 THEN  GOTO 136
132 XI$ =  STR$ ( INT (X))
134 X$ =  LEFT$ (XI$,1) + "." +  MID$ (XI$,2) +  MID$ (X$, LEN (XI$) + 2):
     P$ = "+0" +  STR$ ( LEN (XI$) - 1): GOTO 140
136  IF  MID$ (X$,2,1) = "0" THEN P$ = "-02":X$ =  MID$ (X$,3,1) + "." +
    MID$ (X$,4): GOTO 140
138 P$ = "-01":X$ =  MID$ (X$,2,1) + "." +  MID$ (X$,3)
140 X$ = X$ + "00000000"
142 X$ =  LEFT$ (X$,D + 1)
162 X$ = S$ + X$ + "E" + P$
164  RETURN
```

Program 2.

```
144  REM   ROUNDING ROUTINE : LINES 144-160
146 X$ =  LEFT$ (X$,1) +  MID$ (X$,3)
148 X =  VAL (X$) + 5:X$ =  STR$ (X)
150  IF  LEN (X$) = D THEN  GOTO 160
152 P =  VAL ( RIGHT$ (P$,3)) + 1
154  IF  SGN (P) = 1 THEN  GOTO 158
156 P$ = "-" +  RIGHT$ (("0" +  STR$ ( ABS (P))),2): GOTO 160
158 P$ = "+" +  RIGHT$ (("0" +  STR$ ( ABS (P))),2)
160 X$ =  LEFT$ (X$,1) + "." +  MID$ (X$,2,D - 2)
```

Program Description

Inputs:

X=value to be truncated or rounded, and converted to uniform scientific notation.

D=number of digits in mantissa after truncation.

D-1=number of digits in mantissa after rounding.

Output: X$=converted value.

What the Lines Do:

Line 122 sets sign string, S$, to sign of the number (a blank space for positive numbers).

Line 124 converts absolute value to a string and finds its length.

Line 126 tests to find input numbers already in scientific notation format and converts them to a string format. **X$** becomes the mantissa and **P$** the exponential in this and following conversions.

Line 128 tests to find input numbers that are zero and converts them to the final string format.

Line 130 tests for numbers less than one and sends them to line 136 for further testing.

Line 132: Any input number reaching this line is a fixed point number greater than or equal to one. The line converts its integer value to a string. The length of that string is used in the next line to locate the decimal point.

Line 134 shifts the decimal point by reconcatenation to form a mantissa and forms a string exponential using the length of the string formed in line 132 to determine the magnitude of the number.

Line 136 tests for numbers less than 0.1 and formats a mantissa and exponential for them.

Line 138: Input numbers reaching this line are less than one but greater than or equal to 0.1. It formats a mantissa and exponential for them.

Line 140 concatenates a string of trailing zeros to the mantissas to act as place fillers. (Blank spaces can be substituted for the zeros if preferred unless rounding is to be done.)

Line 142 truncates the string for the mantissa to the desired length.

Line 162 concatenates the sign, mantissa, "E," and exponential strings to form the final result. The user can modify as desired.

Line 164: Return to main program.

In the rounding routine:

Line 146 converts the mantissa string to an integer (removes the decimal point).

Line 148 adds 5 to effect rounding to nearest integer and converts result to a string.

Line 150 tests for mantissas that did not increase in string length (an increase would indicate that a leading 9 had increased to a 10) and sends them to line 160.

Lines 152 to 158 increase the exponential by one for cases where a leading 9 becomes a 10 during rounding.

Line 160 re-concatenates the mantissa with a decimal point in the proper position. ☐

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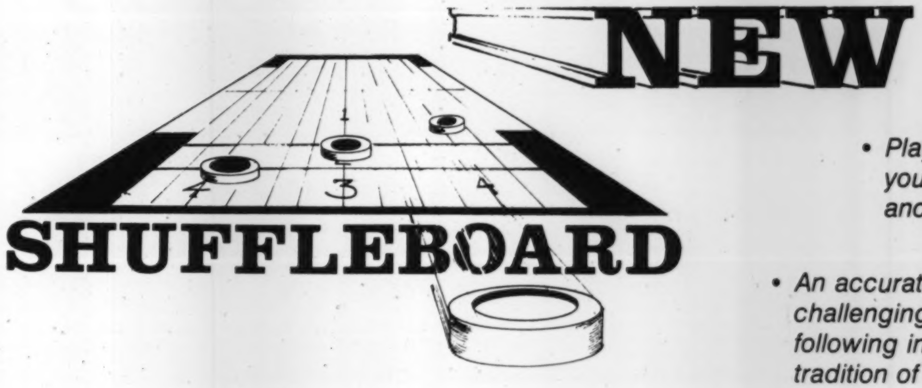

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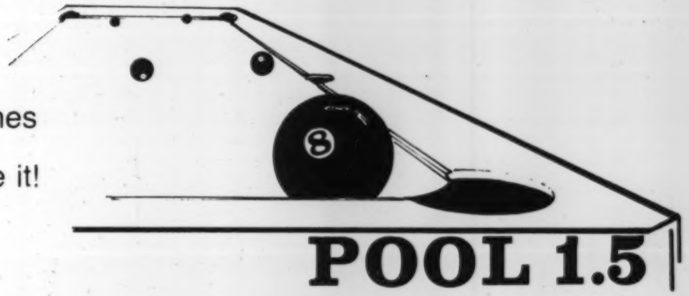

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Unlistable Lines for the TRS-80

Paul Tiernan

The TRS-80 is a marvelous machine which is capable of much more than the Level II Reference Manual would have you believe. Without leaving Basic, it is possible to write a program which will do much more than its listing suggests.

For example: A program when LISTed gives:

```
10 PRINT "JUST A SIMPLE ONE LINER."
```

But when it's RUN

```
THIS IS DEFINITELY NOT
JUST A SIMPLE ONE LINER
```

Or another program LISTs as:

```
10 PRINT "I AM THE WALRUS"
20 PRINT "GOO GOO G'JOOB"
```

and runs as

```
I AM THE WALRUS
GOO GOO G'JOOB
GOO GOO G'JOOB
GOO GOO G'JOOB
GOO GOO G'JOOB
```

As you have probably deduced, there are lines in both runs which do not appear in a listing but are still included in the run. In the first case it is a print statement and in the second it is a FOR-NEXT loop which is "unlistable." In fact almost any line under 115 characters, not including line numbers, can be made unlistable.

But first let's try an example. Type exactly what is written—don't insert or delete spaces or change spellings of words or anything—there will be plenty of time to be creative later.

Type:

```
10 PRINT "HOW IS THIS PRINTED?": REM
THESE WORDS ARE GOING TO DISAPPEAR
```

and ENTER it

Now type: Edit 10 and ENTER. Type 32 then the space bar, then 36C and keep pressing the backspace key until the cursor does not move any further. Now press ENTER. RUN it. LIST it. Amazing isn't it. When you list your program you can't see anything, but when you run it

```
HOW IS THIS PRINTED
```

is displayed. You may have noticed that when you type LIST the line flashes on and then off. Don't worry; this is not noticeable in a long program listing and not, in any case, to the uninitiated!

To generate your own invisible line:

1) Turn the computer on and make sure it is running properly by typing ?MEM and ENTER. The computer should return with 3284 (for 4K) or 15572 (for 16K).

2) Type in and ENTER the line that you want to make unlistable, (it must have fewer than 115 characters).

Answers in a quiz program could be hidden, so that cheating would become almost impossible.

3) LIST the line. Make sure that there is nothing that you may want to change (If there is, do it and return here afterwards).

4) Count the number of characters in the line (including spaces, line numbers, etc.).

5) Type EDIT followed by the number of your line, and ENTER. This puts you into the Insert mode.

6) Press X (and don't ENTER). This brings the cursor to the end of the line and puts you into the Insert mode.

7) Type:

```
:REM
```

Then type the same number of characters as there are characters in the line, plus five. (It doesn't matter what they are; they're going to disappear anyway.)

8) Press the SHIFT and up arrow keys simultaneously.

9) Type in the number corresponding to the previous number of characters in the line plus five, followed by a backspace. (For example, if you had counted 31 characters in step 4, you would type 36 and backspace). This should place the cursor directly after the M in REM. (If it doesn't, type X and go back to step 8).

10) Again type the number that you counted in step 4, plus five, this time followed by a C (Do not ENTER).

11) Keep pressing the backspace key until the cursor doesn't move any further.

12) Now press ENTER. You can RUN or LIST your program as much as you like.

How It Works

The principle is very simple. When you RUN the program, the computer executes the first part of the line, and when it reaches the REM statement it disregards the rest—which consists of backspaces. When you LIST it the entire line is displayed, but, because of the backspaces after the REM statement, the line is printed over. This happens so quickly that it appears that there is no line there.

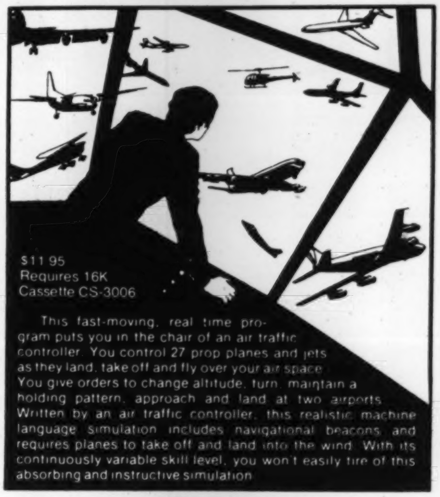
There are quite a few things that this idea could be used for, apart from puzzling your friends who understand Basic. One thought is that answers in a quiz program could be hidden, so that cheating would become almost impossible. (If you choose to use this idea, use line numbers ending in 3, 7 or 9 to prevent accidental EDITing by unwitting students). Another use is that in programs for publication, you can sneak your name in, to stop pirating of your ideas. This is by no means a comprehensive list of uses—just a few ideas to stimulate your imagination. ☐

Paul Tiernan, 117 Military Road, Henley South, South Australia 5022.

TRS-80 sensational software

creative computing software

Air Traffic Controller



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Requires 16K
Cassette CS-3006

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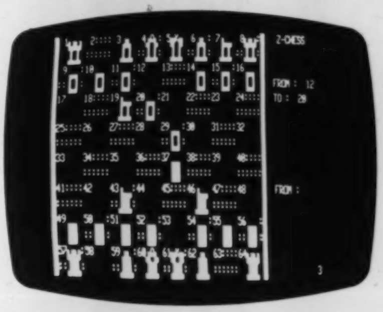
See disk version below.

Z-Chess III

Cassette CS-3017 $19.95 Requires 16K



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See disk version below left.

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F-Chart Solar Energy Analysis eliminates many of the tedious calculations required when designing solar-heating systems. Beyond providing a thermal analysis, the program allows designers to quickly determine the effects of changing any specifications, allowing fast, accurate, and inexpensive experimentation.

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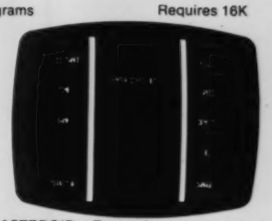

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Random Access for the TRS-80

James H. Garrett

How many times have you sat down at your computer to master random access, but given up in despair?

I had attempted it at least a dozen times and had given up as many times. But, when one of my business programs, using sequential files returned an "out of memory" error, there was no more putting it off. So, out came the manuals, books on programming, all of the magazine articles I had been saving and anything else I could find on the subject.

Here I was again, totally confused, and wanting to quit, but knowing that this time I could not. Everything seemed either to be written for an expert programmer, using very technical language, or was buried in such a maze of gosubs and inkey strings that solving an Adventure game would be a snap compared to figuring it out.

I was eventually able to put it all together, but it was a slow process. The result is a simple program with no bells or whistles. It was written with one objective: learning to use random access files. When this is accomplished, it will be easy to add refinements such as the INKEY$ function, subroutines, and other programming enhancements or frills.

This article does not propose to answer all questions about random access and may even generate more questions than it answers. Many things are passed over lightly with the thought that the reader who wants more detailed information can get it from other sources. The sole purpose of this article is to explain, in simple language, how to get a random access program up and running.

The first thing that must be done is to OPEN a file for random access, assign a buffer, and give the file a name. I chose the name "FILES," but any name will suffice. In my program this is done eight times, one for each time the files are used for the purposes listed in lines 190-260. Each OPEN statement is the same.

The Field Statement

The next step is writing the FIELD statements. These statements are *not* the same. In fact, three different FIELD statements are used, depending on what action is to be taken with the file. This was not explained in any manual or article that I read, and is one of the main reasons for the difficulty I had in learning random access. Let's take a closer look at what the FIELD statement is and why three different ones were required.

Information is stored in chunks of 255 bytes, but forget the word byte and use the word character. Thus, information is stored in chunks of 255 characters. A character is a letter, a number, a space or a punctuation symbol. These 255 characters are called a *physical record*, and when we write to, or read from, the disk, this entire physical record is moved from the computer to the disk or from the disk to the computer. The space for 255 characters is taken up by a physical record regardless of how little information we put into it.

If the information that we wanted to store was exactly 255 characters long the FIELD statement would be simple. In most cases, however, the information is considerably shorter and contains information that has to be separated, such as names and addresses. As a result we have to "define the field."

Put another way, we have to tell the computer how many characters are in the name and how many are in the address. Easy enough. We can estimate that 99% of all names will not exceed 63 characters, and the same is true for most addresses. However, 63 + 63 = 126, so we would not be anywhere near the 255 characters that will be taken up by the physical record.

What we do then, is devise a method of storing two names and two addresses in each physical record. If we do this, 126 + 126 = 252, so we leave the space for only three characters unused. We then have two *subrecords* in each physical record.

Lines 300 to 340 are a FOR-NEXT loop used to input two names and two addresses into the subscripted variables N$(I) and A$(I). When this is done, the program moves to line 350, OPENS the file, and then goes into another FOR-NEXT loop at line 360.

Line 370 begins one of the three FIELD statements used in the program. The first time through the FOR-NEXT loop, I is equal to 0. Zero times anything is zero, so DU$ takes up zero space, N1$(I) is assigned 63 characters and A1$(I) is assigned 63 characters. DU$ is a "dummy" string and is not used for storing information. Its purpose is to format the 255 available characters and enable us to create subrecords. Many confusing explanations of how DU$ is used are already in print so I will not cloud the issue further by giving my own version. It is sufficient to say that "this is one way that it will work."

Now let's look at the FIELD statements in lines 620 and 630. These are similar to the ones discussed above, but are not quite the same. A FOR-NEXT loop is not used; instead the computer is directed to use the specific subscripted variables of N1$(0) and A1$(0) in line 620 and N1$(1) and A1$(1) in line 630. It is possible to use the same method as above, but I wrote it this way intentionally to provide a different approach to the problem.

James H. Garrett, Box 781, Holly Hill, FL 32017.

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CIRCLE 208 ON READER SERVICE CARD

The third FIELD statement is used at line 530. The reason that it is used this way is because we want to look at a subrecord contained within a physical record. This part of the program begins on line 490 where we are asked the number of the item that we want to observe and to input it as the variable "X." Let us say that we want to look at our entry number 410. Thus X = 410. On line 500, PR (the physical record number) is set equal to the integer of 410 - 1 (409) divided by 2 (204) + 1. Thus, PR is equal to 205. The information we want to observe is located on the disk in physical record number 205, but we only want to observe the information contained in the subrecord.

```
10 '            * - * - * - * - * - * - * - *
20 '            *                           *
30 '            *         NO FRILLS         *
40 '            *                           *
50 '            *       RANDOM ACCESS       *
60 '            *                           *
70 '            *        TECHNIQUES         *
80 '            *                            *
90 '            *            BY             *
100 '           *                           *
110 '           *     JAMES H. GARRETT      *
120 '           *         BOX 781           *
130 '           *   HOLLY HILL, FL. 32017   *
140 '           *                           *
150 '           * - * - * - * - * - * - * - *
160 CLEAR 6000
170 DIM N$(20)'                         *** FOR ALPHA SORT ***
180 CLS
190 PRINT "1. ADD TO OR CREATE FILE"
200 PRINT "2. SELECT ONE ITEM TO REVIEW"
210 PRINT "3. REVIEW ENTIRE FILE"
220 PRINT "4. CORRECT ONE ITEM"
230 PRINT "5. CHECK FILES FOR UNUSED RECORDS"
240 PRINT "6. INPUT FILES FOR ALPHA SORT"
250 PRINT "7. CHECK FOR END OF FILE"
260 PRINT "8. SEARCH FOR NAME"
270 INPUT "SELECTION" ; X
280 ON X GOTO 290 , 480 , 600 , 740 , 930 , 1110 , 1300 , 1390
290 CLS'                          *** ADD TO OR CREATE FILE ***
300 FOR I = 0 TO 1
310 INPUT "NAME" ; N$(I)
320 IF N$(I) = "@" THEN 350
330 INPUT "ADDRESS" ; A$(I)
340 NEXT
350 OPEN "R" , 1 , "FILES"
360 FOR I = 0 TO 1
370 FIELD 1 , ( I * 126 ) AS DU$ , 63 AS N1$(I) ,63-AS A1$(I)
380 NEXT
390 FOR I = 0 TO 1
400 LSET N1$(I) = N$(I)
410 LSET A1$(I) = A$(I)
420 NEXT
430 I = LOF (1) + 1
440 PRINT "LOF = " I
450 PUT 1 , I
460 CLOSE
470 GOTO 180
480 CLS'                        *** SELECT ONE ITEM TO REVIEW ***
490 INPUT "WHICH RECORD DO YOU WISH TO SEE" ; X
500 PR = INT ( ( X - 1 ) / 2 ) + 1
510 SR = X - 2 * ( PR - 1 )
520 OPEN "R" , 1 , "FILES"
530 FIELD 1 , (( SR - 1 ) * 126 ) AS DU$ , 63 AS N1$ , 63 AS A1$
540 GET 1 , PR
550 N$ = NP W : A$ = A1$
560 PRINT N$ , A$
570 CLOSE
580 INPUT "PRESS ENTER TO CONTINUE" ; X
590 GOTO 180
600 CLS'                               *** REVIEW ENTIRE FILE ***
610 OPEN "R" , 1 , "FILES"
620 FIELD 1 , 63 AS N1$(0) , 63 AS A1$(0)
630 FIELD 1 , 126 AS DU$ , 63 AS N1$(1) , 63 AS A1F$(1)
640 FOR I = 1 TO LOF (1)
650 GET 1 , I
660 FOR Y = 0 TO 1 : N1$ = N1$(Y) : A1$ = A1$(Y)
670 N$(Y) = N1$ : A$(Y) = A1$(Y)
680 PRINT N$(Y) , A$(Y)
690 INPUT "PRESS ENTER TO CONT" ; Z
700 NEXT Y
710 NEXT I
720 CLOSE
730 GOTO 180
```

Line 510 seems a bit confusing unless we remember that operations in parenthesis are done first, then multiplication and then subtraction. SR (the subrecord) is set equal to PR(205)-1 times two, or 408. This is then subtracted from "X" (410) to give us the number 2. We are now looking for subrecord 2 in physical record 205.

In line 530, we FIELD SR - 1 (or 1) times 126 as DU$ and get subrecord 2 into N1$ and A1$. Notice that these are not subscripted variables this time. Had we wanted the information that was stored in subrecord 1, SR would have been equal to 1. 1-1 = 0. 0 times 126 would equal 0 and DU$ would consume nothing. The first 63 characters would go into N1$ and the second 63 characters into A1$.

Now you know as much about FIELD statements as I do.

The GET Statement

Continuing at line 540 we use the GET statement to get the physical record from disk, and we tell the computer that we want number PR or 205. This it does and the information is stored in N1$ and A1$, which are at this point called "buffer field names" and are not, in the ordinary sense, string variables.

To stay out of trouble in this area, do not use buffer field names as variables elsewhere in your program. Line 550 accomplishes this by making N$ equal to N1$ and A$ equal to A1$. Line 560 prints N$ and A$. We could just as easily have printed N1$ and A1$, but then our buffer field name would have become a variable name and problems could creep in. Again, suffice it to say, "this is one method that will work." If you want to know why, and you are a glutton for confusion, consult the manuals.

We just looked at subrecord number 410, but the file has not yet been created. Let's see how to create or add to a file.

In lines 300 to 340 we input information for storage. Lines 350-380 OPEN the file, name it and set up the field. Line 390 starts another FOR-NEXT loop and in line 400 we run into a new word, "LSET." LSET N1$(I)=N$(I) means to set or place N$(I) into N1$(I) on the left side. In line 370 we FIELDed 63 as N1$(I) so N1$(I) is 63 characters long. If the name that we entered as N$(I) in line 310 is "Smith" (5 characters), N1$(I) would start on the left as Smith and would be followed by (63-5) or 58 spaces.

In the same manner, if the name that we entered was 65 characters long, we would only have room for 63 of them, so the last two would be chopped off. The number of characters that we FIELD is what is used; no more and no less. And this brings up a problem for you to solve. Because all 63 characters are used, many blanks are on the right and should be removed when we bring the record back from the disk. What is a fast way to remove them?

On with the program. Line 430 establishes where the end of the file is so that our new information can be PUT at the end. Line 440 tells us where the end is, and line 450 PUTs it there. Line 460 CLOSEs the file, and we then return to the menu.

Correcting

Now we can add to the file and review one item in the file. How do we correct an item? Glad you asked. Correcting is the same as reviewing (lines 490 to 560), but at that point correcting takes a different direction. If you are with me up to here, I don't think that we need to tell each other that a subroutine could have been used.

Anyway, lines 750 to 820 are the same as 490 to 560 which were reviewed earlier. Line 830 prompts us to enter an "at" symbol if we want to delete the name from the file, or type in the name as it should be. If the name is deleted, line 870 deletes anything stored in A$ to eliminate possible future problems. The rest of this section is the same as adding to the file.

The other parts of the program are "goodies" that would be used as internal parts of other routines, but are shown as stand alone routines for clarity. For example, "Check Files for Unused Records" could be put into the "ADD TO FILES" part of the program to automatically fill in subrecords that had been deleted in the past.

The "Input for Alpha Sort" would be used so that names could be machine sorted instead of disk sorted, which will save disk wear. Using only the first four characters of the names to be sorted will speed up sorting and conserve memory.

The "Check for End of File" should be built into the program so that it is impossible to attempt to put more information on a disk than it will contain.

The "Search for Name" routine was thrown in because some manuals indicate that you have to have a written copy of your files showing the record number, or remember each record number, to find anything. This routine will give you all names that begin with the first three letters of the name that you are seeking. This could have been done more efficiently with a MID$ routine, but here again I wanted to keep the overall program simple.

Anyway, this should be enough information to get you started with random access. I hope it will save you much of the frustration that I encountered, and maybe will get you to the point that the manuals can be understood. □

```
 740 CLS'                                      *** CORRECT ONE ITEM ***
 750 INPUT "WHICH RECORD DO YOU WISH TO CORRECT" ; X
 760 PR = INT ( ( X - 1 ) / 2 ) + 1
 770 SR = X - 2 * ( PR - 1 )
 780 OPEN "R" , 1 , "FILES"
 790 FIELD 1 , ((SR - 1) * 126) AS DU$ , 63 AS N1$ , 63 AS A1$
 800 GET 1 , PR
 810 N$ = N1$ : A$ = A1$
 820 PRINT N$ , A$
 830 PRINT "ENTER @ TO DELETE FROM FILE"
 840 INPUT "CHANGE NAME" ; N$
 850 IF N$ = "@" THEN 870
 860 INPUT "CHANGE ADDRESS" ; A$ : GOTO 880
 870 A$ = ""
 880 LSET N1$ = N$
 890 LSET A1$ = A$
 900 PUT 1 , PR
 910 CLOSE
 920 GOTO 180
 930 CLS'                        *** CHECK FILES FOR UNUSED RECORDS ***
 940 C = 0
 950 PRINT "THE FOLLOWING RECORD NUMBERS ARE OPEN"
 960 OPEN "R" , 1 , "FILES"
 970 FIELD 1 , 63 AS N1$(0) , 63 AS A1$(0)
 980 FIELD 1 , 126 AS DU$ , 63 AS N1$(1) , 63 AS A1$(1)
 990 FOR I = 1 TO LOF (1)
1000 GET 1 , I
1010 FOR Y = 0 TO 1 : N1$ = N1$(Y) : A1$ = A1$(Y)
1020 C = C + 1
1030 N$(Y) = N1$ : A$(Y) = A1$(Y)
1040 IF LEFT$ ( N1$ , 1 ) = "@" THEN 1050 ELSE 1060
1050 PRINT C
1060 NEXT Y
1070 NEXT I
1080 CLOSE
1090 INPUT "PRESS ENTER TO CONTINUE" ; X
1100 GOTO 180
1110 CLS'                           *** INPUT FILES FOR ALPHA SORT ***
1120 C = 0
1130 OPEN "R" , 1 , "FILES"
1140 FIELD 1 , 63 AS N1$(0) , 63 AS A1$(0)
1150 FIELD 1 , 126 AS DU$ , 63 AS N1$(1) , 63 AS A1$(1)
1160 FOR I = 1 TO LOF (1)
1170 GET 1 , I
1180 FOR Y = 0 TO 1 : N1$ = N1$(Y)
1190 IF LEFT$ ( N1$ , 1 ) = "@" THEN 1220
1200 C = C + 1
1210 N$(C) = LEFT$ ( N1$ , 4 )
1220 NEXT Y
1230 NEXT I
1240 CLOSE
1250 FOR I = 1 TO C
1260 PRINT I , N$(I)
1270 NEXT
1280 INPUT "PRESS ENTER TO CONTINUE" ; X
1290 GOTO 180
1300 CLS'                                 *** CHECK FOR END OF FILE ***
1310 OPEN "R" , 1 , "FILES"
1320 FIELD 1 , 63 AS N1$(0) , 63 AS A1$(0)
1330 FIELD 1 , 126 AS DU$ , 63 AS N1$(1) , 63 AS A1$(1)
1340 PRINT "END OF FILE IS "LOF (1) : X = LOF (1)
1350 PRINT : PRINT "THERE ARE " X * 2 " RECORDS IN THE FILE"
1360 CLOSE
1370 INPUT "PRESS ENTER TO CONTINUE" ; X
1380 GOTO 180
1390 CLS'                                     *** SEARCH FOR NAME ***
1400 C = 0
1410 INPUT "WHAT IS THE NAME THAT YOU ARE LOOKING FOR" ; N$
1420 OPEN "R" , 1 , "FILES"
1430 FIELD 1 , 63 AS N1$(0) , 63 AS A1$(0)
1440 FIELD 1 , 126 AS DU$ , 63 AS N1$(1) , 63 AS A1$(1)
1450 FOR I = 1 TO LOF (1)
1460 GET 1 , I
1470 FOR Y = 0 TO 1 : N1$ = N1$(Y)
1480 C = C + 1
1490 IF LEFT$ (N1$ , 3) = LEFT$ (N$ , 3) THEN 1500 ELSE 1510
1500 PRINT C , N1 $
1510 NEXT Y
1520 NEXT I
1530 CLOSE
1540 INPUT "PRESS ENTER TO CONTINUE" ; X
1550 GOTO 180
```

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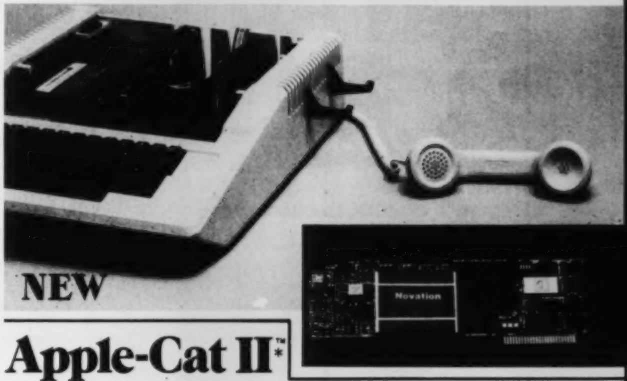

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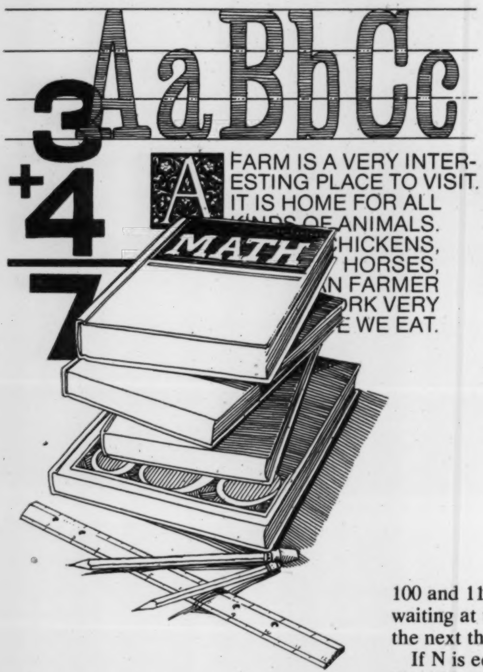
CIRCLE 287 ON READER SERVICE CARD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MATH

Grammar on the Microcomputer

Glenn Fisher

You've just written a program you're proud of. You show it to a friend who starts laughing when your program says, "That is a elephant." Then, "You got it right in 1 turns!" shows up. Cheer up—this article will show you how to teach your microcomputer correct grammar, and in the process give you some practice in using string functions. It will also introduce you to that wonderful operator, the semicolon.

You will end up with some routines you can include in your programs to make their output grammatically correct, so your friends (and purchasers) will say "Wow, how neat!" instead of "'1 counters'—that's pretty funny!"

Plurals

Plurals are easy to do; they simply involve adding "s" to the end of a word when you have more than one of something. So we will need two things in our routine: an "s" to add, and a check that the number is more than one (actually, since we usually add "s" to zero amounts—zero counters—we need to check that the number is not equal to one). Here's the routine:

```
100 PRINT"YOU TOOK";N;
    "COUNTER";
110 IF N<>  1 THEN PRINT "S";
120 PRINT
```

N, of course, can be whatever variable you are using in your program. The action lies in the semicolons at the end of lines 100 and 110, which keeps your computer waiting at the next space on that line for the next thing to print.

If N is equal to 1, the program goes to line 120 and the PRINT causes the computer to go on to the next line. However, if N is NOT equal to 1, the computer will print the letter "S" in the next space (right after COUNTER), and then the PRINT in line 120 will cause the computer to go on to the next line.

If the plural occurs in the middle of a line of print, the remainder of the line can be printed in line 120.

```
100 PRINT "IN";N;"TURN";
110 IF N <>  1 THEN PRINT "S";
120 PRINT "YOU GOT";R;"RIGHT."
```

The statement in line 120 *must* start with a space, since the semicolon leaves no space between strings (lists of letters or other characters) when they are printed.

Words which change their form from singular to plural take a little more work. I usually just find an easier way to do it; for example, printing "This is try #1" instead of "You have had 1 try." Here's one way to do it:

```
100 PRINT "OUT OF";N;"TR";
110 IF N=1 THEN PRINT "Y";:GOTO
    130
120 PRINT "IES";
130 PRINT "YOU GOT";R;"RIGHT."
```

On the PET, with its nice cursor control keys, you can put the "s" on the word, then check for the value equal to 1 to remove it:

```
100 PRINT "YOU TOOK""N"COUN-
    TERS";: I N=1 THEN PRINT "←";
110 PRINT
```

What you print is a backspace (Shift-cursor across) then a space to erase the "s."

Correct Articles

"That is a animal"? Only on a computer, and it's easy to fix. Usually the problem occurs (as in the game Animal) when the user has entered a word (as the variable W$ in the following example). We need to check that the first letter of the word is a vowel. LEFT$(W$,1) provides us with the first letter. MID$(W$,1,1) will also work.

```
90 EN$=" ":REM EQUALS A SPACE
100 L$=LEFT$(W$,1)
110 IF L$="A" OR L$="E" OR L$="I"
    OR L$="O" OR L$="U" THEN EN$
    ="N":REM EN$="N,SPACE"
120 PRINT "THAT IS A";EN$;W$;"."
```

If the word starts with a vowel, line 110 will set EN$ equal to N space, and line 120 will print "THAT IS AN . . ." EN$ is initially set to just a space in line 90 so a word starting with a consonant will have a space printed between the "a" and the word: "THAT IS A . . ." The semicolons between "THAT IS A," EN$, and W$ in line 120 guarantee that they are printed with no spaces between, so you have to put in the one you want after "a" or "an". The advantage of this method (storing the value as a variable, EN$) over the one used for plurals is that you can get the correct article every time W$ appears by just preceding it with ". . . A";EN$;. The other routine takes three lines every time you want the plural. You will need to look at your program and see which method meets your needs.

Now you've learned a little about the semicolon and some string functions. Hopefully you can teach your computer to use correct grammar! Now for the final exam—can you figure out a way to get "an hour" and "a house?" □

Glenn Fisher, 1517 Holly St., Berkeley, CA 94702.

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Gary Kessler

Computers are much better than humans at figuring the number of days between two dates, finding the day of a given date, or knowing whether 1700 was a leap year. Instead of requiring users to input this information, why not include calendar calculations in your programs?

I have had to write several date manipulation routines, and see no reason why others should re-invent the wheel when there is other important stuff to do, so I have described here five routines that I have found very useful.

Note that all routines assume they are receiving only good data. This is, of course, a terrible assumption. I leave it to the user of these routines to create his own error checking methods. (This disclaimer is consistent with Kessler's Law of Computer Programming which states that a documented bug is a feature.)

All routines need an array in the main program containing the number of days in each month. Listing 1 shows a sample piece of code to accomplish this.

Leap Year Calculation

The problem of handling leap years will occur in all calculations dealing with dates. Just for review, now: each fourth year is a leap year. The tricky part is that centennial years (even centuries) are not Leap, *except* every fourth centennial is a leap year. For our purposes, a year is not leap if not divisible by 4. If divisible by 4 and by 100, it is Leap only if divisible by 400 (e.g., 1971 was not a leap, but 1972 was; 1900 was not a leap year, but 2000 will be.) A program to handle this determination is shown in Listing 2.

Convert Gregorian Date to Julian

Our normal style of writing dates—month/day/year—is based on the Gregorian calendar, the modern version of which has been around since about 1582. A Julian date is stored as the year followed by the day number, where January 1 is day 1, February 1 is day 32, etc. (e.g., February 3, 1972 would be 72034). The advantage of Julian dates is that they make date calculations such as determining the number of days between two dates, easy.

A drawback of all these methods however, is that only a two-digit year is saved. You can modify these routines easily to overcome this problem, especially if your machine can store eight digits in an integer word. A Gregorian-to-Julian conversion program is shown in Listing 3.

Convert Julian Date to Gregorian

Since Julian dates are not easily usable by people, it is useful to be able to go back and forth. A Julian-to-Gregorian converter is shown in Listing 4.

Number of Days Between Two Dates

Many applications, banking and financial ones, for example, need to be able to calculate the number of days between two dates. A routine which takes two dates in Gregorian format (presuming the first date precedes the second date) and counts how many days are between them is shown in Listing 5.

```
100   DIM D9(12)
110   FOR I = 1 TO 12
120     READ D9 (I)
130   NEXT I
140   DATA  31,28,31,30,31,30,31,31,30,31,30,31
```

Listing 1.

```
500   REM  TEST TO SEE IF GIVEN YEAR IS LEAP OR NOT
510   REM
520   REM   Y = YEAR (4 DIGITS)
530   REM   L = 0 IF NOT A LEAP YEAR,
540   REM       1 IF IT IS A LEAP YEAR
550   REM
560   LET L = 0
570   IF INT (Y/4) * 4 <> Y  THEN 610
580   IF INT (Y/100) * 100 <> Y  THEN 600
590   IF INT (Y/400) * 400 <> Y  THEN 610
600   LET L = 1
610   RETURN
```

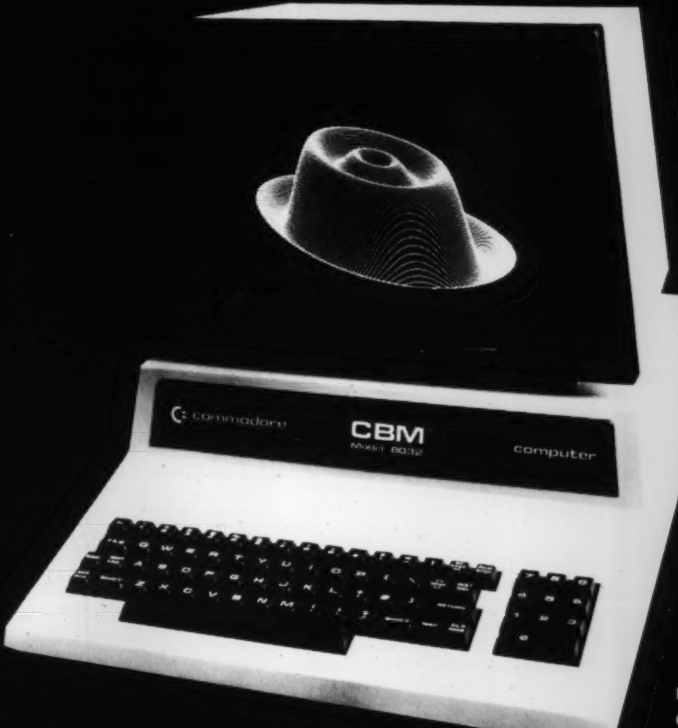
Listing 2.

```
1000   REM  CONVERT GREGORIAN DATE TO JULIAN
1010   REM  M = MONTH (1-12)
1020   REM  D = DAY (1-D9(M))
1030   REM  Y = YEAR (0000-9999)
1040   REM
1050   LET D1 = 0
1060   IF M = 1 THEN 1110
1070   LET M1 = M - 1
1080   FOR I = 1 TO M1
1090     LET D1 = D1 + D9 (I)
1100   NEXT I
1110   D1 = D1 + D
1120   IF M < 3  THEN 1180
1130   GOSUB 560
1140   IF L = 0  THEN 1180
1150   REM  FOUND LEAP YEAR & DATE AFTER 1 MARCH.
1160   LET D1 = D1 + 1
1170   REM
1180   LET Y1 = Y - INT (Y/100) * 100
1190   LET J = Y1 * 1000 + D1
1200   RETURN
```

Listing 3.

Gary Kessler, Academic Computer Center, St. Michael's College, Winooski, VT 05404.

80 COLUMN GRAPHICS



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The image on the screen was created by the program below.

```
 10 VISMEM: CLEAR
 20 P=160: Q=100
 30 XP=144: XR=1.5*3.1415927
 40 YP=56: YR=1: ZP=64
 50 XF=XR/XP: YF=YP/YR: ZF=XR/ZP
 60 FOR ZI=-Q TO Q-1
 70 IF ZI<-ZP OR ZI>ZP GOTO 150
 80 ZT=ZI*XP/ZP: ZZ=ZI
 90 XL=INT(.5+SQR(XP*XP-ZT*ZT))
100 FOR XI=-XL TO XL
110 XT=SQR(XI*XI+ZT*ZT)*XF: XX=XI
120 YY=(SIN(XT)+.4*SIN(3*XT))*YF
130 GOSUB 170
140 NEXT XI
150 NEXT ZI
160 STOP
170 X1=XX+ZZ+P
180 Y1=YY-ZZ+Q
190 GMODE 1: MOVE X1,Y1: WRPIX
200 IF Y1=0 GOTO 220
210 GMODE 2: LINE X1,Y1-1,X1,0
220 RETURN
```

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Date, continued...

```
2000   REM  CONVERT JULIAN DATE TO GREGORIAN
2010   REM  J = JULIAN DATE, FORM YYDDD
2015   REM      NOTE - ONLY A 2-DIGIT YEAR IS SAVED
2020   REM
2030   LET Y = INT (J/1000)
2040   LET J1 = J - Y * 1000
2050   REM  CHECK FOR LEAP YEAR
2060   GOSUB 560
2070   IF L = 0  THEN 2120
2080   IF J1 <= 59  THEN 2120
2090   REM  LEAP YEAR WITH DAY AFTER 2/29
2100   LET J1 = J1 - 1
2110   REM
2120   LET D1 = 0
2130   FOR M = 1 TO 12
2140     LET D = J1 - D1
2150     IF D <= D9(M)  THEN 2180
2160     LET D1 = D1 + D9 (M)
2170   NEXT M
2180   RETURN
```

Listing 4.

```
3000   REM FIND THE NUMBER OF DAYS BETWEEN 2 DATES
3010   REM
3020   REM  BOTH DATES ARE IN GREGORIAN FORM, WHERE THE
3030   REM     1ST DATE PRECEDES THE 2ND.
3040   REM
3050   REM  M7,D7,Y7 IS 1ST DATE & M8,D8,Y8 IS THE 2ND DATE.
3060   REM
3070   REM  J1 IS THE DAY # OF THE 1ST DATE, FROM JULIAN
3080   REM  J2 IS THE DAY # OF THE 2ND DATE, FROM JULIAN
3090   REM  N IS THE NUMBER OF DAYS BETWEEN J1 & J2
3100   REM
3110   LET M = M7
3120   LET D = D7
3130   LET Y = 9999
3140   GOSUB 1050
3150   LET J1 = J - INT (J/1000) * 1000
3160   LET M = M8
3170   LET D = D8
3190   GOSUB 1050
3200   LET J2 = J - INT (J/1000) * 1000
3210   LET N = J2 - J1 + 365 * (Y8 - Y7)
3220   REM
3230   REM  MUST HANDLE INTERVENING LEAP YEARS, IF ANY
3240   REM
3250   LET L1 = Y7
3260   IF M7 <= 2 THEN 3280
3270   LET L1 = Y7 + 1
3280   LET L2 = Y8
3290   IF M8 >= 3 THEN 3310
3300   LET L2 = Y8 - 1
3310   IF L1 > L2  THEN 3370
3320   FOR Y = L1 TO L2
3330     GOSUB 560
3340     IF L = 0  THEN 3360
3350     LET N = N + 1
3360   NEXT Y
3370   RETURN
```

Listing 5.

Day-of-Week from Date

It is often very useful to have a program automatically calculate the day of the week from the date. The routine in Listing 6 uses a well-known formula for this calculation, and returns a 1 for Sunday, 2 for Monday, ..., 7 for Saturday. The input is the date in Gregorian format and the year is needed with all four digits.

Weekend Dates in a Month

This routine has a more specialized

```
4000   REM  FIND DAY-OF-WEEK FROM M, D & Y.
4010   REM  RETURN W = WEEKDAY, WHERE 1 = SUNDAY,....7 = SATURDAY
4020   REM
4030   GOSUB 560
4040   IF L = 0  THEN 4070
4050   LET D9 (2) = 29
4060   REM
4070   LET W = Y - 1751 + INT((Y-1753)/4) - INT((Y-1701)/100)
4075   LET W = W + INT((Y-1601)/400)
4080   LET W = W - INT ((W-1)/7) * 7
4090   LET M1 = M - 1
4095   IF M1 = 0 THEN 4130
4100   FOR I = 1 TO M1
4110     LET W = W + D9 (I)
4120   NEXT I
4130   W = W + D - 1
4140   W = W - INT ((W-1)/7) * 7
4150   LET D9 (2) = 28
4160   RETURN
```

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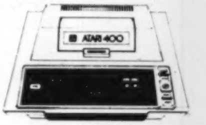

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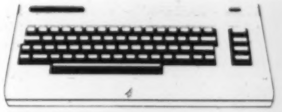

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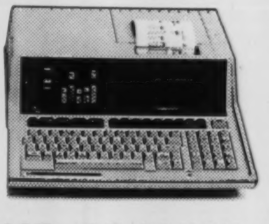

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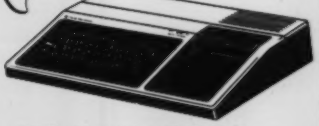

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CIRCLE 148 ON READER SERVICE CARD

Date, continued...

purpose. I wrote it when I was working in a department where certain reports were to be submitted on three consecutive work days. Since no penalty was given when a weekend came in the middle of those days, I created the routine shown in Listing 7 to determine all weekend dates in a given month. Note that another array will be needed to store up to 10 dates, and no month will ever have more than 10 weekend days in it.

I hope these routines will save you some work, or inspire you to do interesting things with dates. I have not yet been energetic enough, for instance, to write something to figure out the days of all the holidays that will occur during a given year, with associated "hidden" Fridays and Mondays. Perhaps that is the next logical entension.

All of these programs were written by me in Fortran, and are currently in use. Users who wish to see listings of these Fortran subroutines should contact me.

However, since Basic seems to be the "conversational" language in this magazine, I translated them into as basic a Basic as I could manage. I would like to thank my friend, Richard S. Moss, C.P.A., for allowing me to test them on his Commodore PET. ☐

```
090  DIM W9(10)
          :
          :
          :
5000  REM  DETERMINE ALL WEEKEND DATES IN A GIVEN MONTH AND
5010  REM  YEAR.  INPUT M AND Y, WITH ALL 4 DIGITS.
5020  REM
5030  REM  RETURN W9 = ARRAY LIST OF ALL WEEKEND DATES
5040  REM      AND W8 = LENGTH (NO. OF ENTRIES) IN W9
5050  REM
5060  LET D = 1
5062  LET W8 = 0
5064  FOR I = 1 TO 10
5066     LET W9 (I) = 0
5068  NEXT I
5070  GOSUB 4030
5080  IF W <> 1  THEN 5110
5090  LET W9 (1) = 1
5100  LET W8 = W8 + 1
5110  LET S1 = 7 - W + 1
5120  GOSUB 560
5130  IF L = 0  THEN 5150
5140  LET D9 (2) = 29
5150  FOR J = 1 TO 5
5160     LET W8 = W8 + 1
5170     LET W9 (W8) = S1
5180     IF S1 = D9 (M)  THEN 5270
5190     LET W8 = W8 + 1
5200     LET W9 (W8) = S1 + 1
5210     REM
5220     LET S1 = S1 + 7
5230     IF S1 > D9 (M)  THEN 5270
5240  NEXT J
5250  REM
5260  LET D9 (2) = 28
5270  RETURN
```

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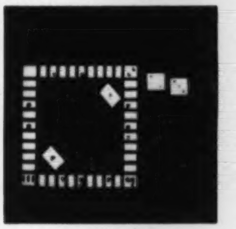
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CIRCLE 204 ON READER SERVICE CARD

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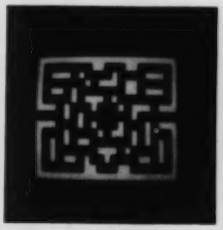
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BLINKING CURSOR BLINKING CURSOR

for the TRS-80

Ray C. Horn Jr.

Blinking Cursor! A really nice feature if you happen to own an Apple II. But what if you own a TRS-80? Are you doomed forever to have nothing but a do-nothing underline cursor? Never fear, an answer is close at hand.

In this article I present four Assembly listings outlining two techniques which almost any TRS-80 owner can use to get an action-packed blinking cursor.

The first technique involves using the keyboard device control block driver address that Basic calls whenever keyboard input is needed, so the cursor only blinks when Basic is waiting for user input.

The second technique involves using the real time clock hardware interrupt generated from the expansion interface as a time base for a blinking cursor. This makes it possible to have a continuously blinking cursor as long as the user does not press the system reset.

All TRS-80 owners should be able to use the first technique since all TRS-80s use a certain amount of keyboard input through the running of normal Level II Basic, but there may be isolated cases where a TRS-80 owner may have the expansion box connected without disks and a software spooler running off the keyboard DCB. I decided to cover these few isolated cases because I own a 48K TRS-80 with an expansion box and no disks, so I can run a blinking cursor using either technique.

Ray Horn Jr. PSC Box 3303, Edwards AFB, CA 93523

The relative strengths and weaknesses of the two methods depend upon whether or not you have an expansion interface with the real time clock feature. Both techniques take an equal amount of memory.

There is one important consideration to bear in mind when deciding to use the real time clock interrupt driven blinking cursor. Cassette I/O will work reliably only with Model I Level III Basic. This is because without Level III Basic, cassette I/O will become garbled because the ISR (interrupt service routine) will be called continuously every 25ms during cassette operation.

With Level III Basic there are some new cassette I/O commands that were designed to be used with the real time clock. 'LOAD' disables all interrupts before cassette input then re-enables the interrupts before going back to Basic, and the 'SAVE' command works the same way. Since I did not write the blinking cursor routines with Level III in mind I'll leave it up to the user to determine the necessary changes that are needed in order to get BLINKs 3.0 and 3.21 (see Listing 3 and 4) to work properly.

BLINKS 3.0 and 3.21 were designed to be used in a clean Level II environment without any cassette I/O as demonstration routines to show that the basic principles do work. The same goes for BLINKs 2.0 and 4.0 as they, too, are only for demonstration purposes. It would take a bit more work to get the BLINKs to work properly outside of a clean Level II set up.

Assembly Listing Comments

There are four Assembly Language listings included with this article. Listing 1, BLINK 2.0, was originally intended to be used at the top of my 48K PMC-80 computer but may be easily relocated using an assembler by altering the 'ORG' on line 140.

Listing 2, BLINK 4.0, is an optimized BLINK 2.0 using only 51 bytes as compared to Listing 1, which needs a total of 71 bytes for a saving of 20 bytes.

Listing 3, BLINK 3.0, is actually BLINK 2.0 retrofitted for use with the real time clock hardware interrupt service routine.

Listing 4, BLINK 3.21, is an optimized BLINK 4.0 using only 86 bytes.

All four listings are well commented and all techniques are fairly straightforward with few, if any, programming tricks. Careful study of all four listings should prove enlightening for assembly hackers having difficulty implementing a blinking cursor on a TRS-80 or PMC-80. ☐

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CIRCLE 137 ON READER SERVICE CARD

Listing 1.

```
                    00100 ;          BLINKING CURSOR PATCH VERSION 2.0
                    00110 ;              WRITTEN BY :  RAY C. HORN JR.
                    00120 ;            <C>. COPYRIGHT  9 AUGUST 1980
                    00130 ;
FFB8                00140            ORG  OFFB8H ; CHANGE AS NECESSARY
                    00150 ;
                    00160 ;  PATCH LINK INITIALIZATION:
                    00170 ;
FFB8  2A 16 40      00180 LINKB     LD   HL,(4016H) ; GET OLD VECTOR
FFBB  22 BC FF      00190           LD   (JUMP+1),HL ; OLD ADDRESS
FFBE  21 CC FF      00200           LD   HL,BLINK    ; GET NEW VECTOR
FFC1  22 16 40      00210           LD   (4016H),HL ; LINK TO BLINK
FFC4  C3 72 00      00220           JP   0072H      ; BACK TO BASIC 'READY
                    00230 ;
                    00240 ;         SYSTEM VARIABLES  ETC.:
                    00250 ;
                    00260 ;  CONSTANTS:
FFC7  8F            00270 CURSOR    DEFB 8FH  ; ALLOW USER MODIFICATION
FFC8  F4 01         00280 LIMIT     DEFW 500  ; USER MAY MODIFY BLINK RATE

                    00290 ;
                    00300 ;  VARIABLES:
FFCA  00            00310 CMODE     DEFB 00 ; 0=OFF , 1=ON
FFCB  00 00         00320 COUNT     DEFW 0000H ; INITIALLY 0
                    00330 ;
                    00340 ;
                    00350 ;  END SYSTEM VARIABLES.
                    00360 ;
                    00370 ;
                    00380 ;         BLINK 2.0 PATCH CODE:
                    00390 ;
FFCC  2A CB FF      00400 BLINK     LD   HL,(COUNT) ; GET LAST 'COUNT'
FFCF  23            00410           INC  HL          ; BUMP IT
FFD0  EB            00420           EX   DE,HL       ; DE=COUNT , HL= ?
FFD1  2A C8 FF      00430           LD   HL,(LIMIT) ; GET UPPER LIMIT
FFD4  AF            00440           XOR  A           ; ZAP CY
FFD5  ED 52         00450           SBC  HL,DE       ; COMPUTE MAX LIMIT ?
FFD7  EB            00460           EX   HL,DE ; HL=COUNT , DE=LIMIT-COUNT
FFD8  22 CB FF      00470           LD   (COUNT),HL ; UPDATE COUNT

FFDB  20 24         00480           JR   NZ,JUMP   ; IF NOT MAX LIMIT !
FFDD  ED 53 CB FF   00490           LD   (COUNT),DE ; ELSE ZERO COUNTER
FFE1  3A CA FF      00500           LD   A,(CMODE) ; GET MODE SETTING
FFE4  FE 00         00510           CP   0          ; DOES MODE=OFF ?
FFE6  28 08         00520           JR   Z,TURNON  ; IF SO, CHANGE MODE
FFE8  AF            00530           XOR  A          ; ELSE MODE=ON, TURN OFF
FFE9  32 CA FF      00540           LD   (CMODE),A ; SET MODE=OFF
FFEC  3E 20         00550           LD   A,20H     ; GET CURSOR 'OFF' CHAR.
FFEE  18 07         00560           JR   SETIT     ; GO  STORE CHAR.
FFF0  3C            00570 TURNON    INC  A          ; MODE=OFF, TURN ON
FFF1  32 CA FF      00580           LD   (CMODE),A ; SET MODE=OFF+1=ON
FFF4  3A C7 FF      00590           LD   A,(CURSOR); GET CURSOR 'ON' CHAR.
FFF7  2A 20 40      00600 SETIT     LD   HL,(4020H); GET CURSOR LOC. ADDRS
FFFA  77            00610           LD   (HL),A    ; STORE NEW CURSOR
FFFB  C3 E3 03      00620 JUMP      JP   03E3H     ; CHANGED BY LINKB
                    00630 ;
                    00640 ;
FFFD                00650 ENDPRG    EQU  $      ; END OF PROGRAM HERE!
0045                00660 BYTES     EQU  ENDPRG-LINKB ; COMPUTE BYTES USEI
                    00670 ;
FFB8                00680           END  LINKB  ; AUTO-START HERE!
```

Listing 2.

```
                    00100 ;          BLINKING CURSOR PATCH VERSION 4.0
                    00110 ;             WRITTEN BY:  RAY C. HORN JR.
                    00120 ;           <C>. COPYRIGHT  9 AUGUST 1980
                    00130 ;
FFCC                00140          ORG    OFFCCH  ; CHANGE AS NECESSARY
                    00150 ;
                    00160 ;     PATCH LINK INITIALIZATION:
                    00170 ;
FFCC  2A 16 40      00180 LINKB   LD     HL,(4016H)   ; GET OLD VECTOR
FFCF  22 FD FF      00190         LD     (JUMP+1),HL  ; COMPLETE CIRCUIT
FFD2  21 E0 FF      00200         LD     HL,BLINK     ; GET NEW VECTOR
FFD5  22 16 40      00210         LD     (4016H),HL   ; STORE IT
FFD8  D9            00220         EXX                 ; SWITCH BANKS
FFD9  21 00 00      00230         LD     HL,0000H     ; ZERO COUNTER
FFDC  D9            00240         EXX                 ; SWITCH BACK
FFDD  C3 72 00      00250         JP     0072H        ; BACK TO BASIC
                    00260 ;
                    00270 ;
                    00280 ;       BLINK 4.0 PATCH CODE:
                    00290 ;

FFE0  D9            00300 BLINK   EXX                       ; SWITCH TO HL
FFE1  23            00310         INC    HL                 ; BUMP COUNTER
FFE2  CB 4C         00320         BIT    1,H    ; CHECK HL=512 FROM 0
FFE4  28 15         00330         JR     Z,JUMP01  ; IF COUNT<LIMIT
FFE6  CB 8C         00340         RES    1,H                ; ZERO COUNTER
FFE8  CB 7C         00350         BIT    7,H                ; MODE=OFF ? [0]
FFEA  28 06         00360         JR     Z,TURNON     ; IF SO, CHANGE MODE
FFEC  CB BC         00370         RES    7,H ;ELSE MODE=ON[1],SET MODE=OF
FFEE  3E 20         00380         LD     A,20H          ; GET CURSOR OFF CHA
FFF0  18 04         00390         JR     SETIT   ;GO  STORE CHAR@[CURSOR]
FFF2  CB FC         00400 TURNON  SET    7,H          ; MODE=OFF, SO TURN ON
FFF4  3E 8F         00410         LD     A,8FH   ; GET CURSOR ON CHAR
FFF6  ED 5B 20 40   00420 SETIT   LD     DE,(4020H); GET CURSOR LOC.ADDRS
FFFA  12            00430         LD     (DE),A     ; STORE CHAR ON SCREEN
FFFB  D9            00440 JUMP01  EXX                 ; SWITCH BACK
FFFC  C3 E3 03      00450 JUMP    JP     03E3H        ; CHANGED BY LINKB
                    00460 ;
                    00470 ;
FFFF                00480 ENDPRG  EQU    $    ; MARK END OF PROGRAM HERE
0033                00490 BYTES   EQU    ENDPRG-LINKB ; # OF BYTES USED
                    00500 ;
FFCC                00510         END    LINKB ; AUTO-START HERE.
```

Listing 3.

```
                    00100 ; BLINKING CURSOR PATCH VERSION 3.0
                    00110 ;   WRITTEN BY: RAY C. HORN JR.
                    00120 ; <C> COPYRIGHT 9 AUGUST 1980
                    00130 ;
FFA1                00140           ORG OFFA1H ; CHANGE AS NECESSARY
                    00150 ;
                    00160 ; PATCH LINK INITIALIZATION:
                    00170 ;
FFA1  F3            00180  LINKB   DI            ; DISABLE INTERUPTS
FFA2  ED 56         00190          IM 1          ; INTERUPT MODE 1
FFA4  3E C3         00200          LD A,0C3H   ; GET JUMP CODE BYTE
FFA6  32 12 40      00210          LD (4012H),A ; STORE IT AT RST 38H
FFA9  21 B7 FF      00220          LD HL,ISR   ; GET INTERUPT SERV. ADDRS
FFAC  22 13 40      00230          LD (4013H),HL ; STORE IT AT RST 38H+1
FFAF  FB            00240          EI            ; START BLINKING
FFB0  C3 72 00      00250          JP 0072H    ; BACK TO BASIC!
                    00260 ;
                    00270 ; SYSTEM VARIABLES  ETC:
```

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6	BREAKEVN	Breakeven analysis
7	DEPRSL	Straightline depreciation
8	DEPRSY	Sum of the digits depreciation
9	DEPRDB	Declining balance depreciation
10	DEPRDDB	Double declining balance depreciation
11	TAXDEP	Cash flow vs. depreciation tables
12	CHECK2	Prints NEBS checks along with daily register
13	CHECKBK1	Checkbook maintenance program
14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIN	Rate of return on investment with variable inflows
18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQUOQ	Fixed quantity economic order quantity model

	NAME	DESCRIPTION
53	FQEOWSH	As above but with shortages permitted
54	FQEOQPB	As above but with quantity price breaks
55	QUEUECB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAP1	Cap. Asset Pr. Model analysis of project
59	WACC	Weighted average cost of capital
60	COMPBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSBUD	DOME business bookkeeping system
77	TIMECLCK	Computes weeks total hours from timeclock info.
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
96	LOANAFFD	Loan amount a borrower can afford
97	RENTPRCH	Purchase price for rental property
98	SALELEAS	Sale-leaseback analysis
99	RRCONVBD	Investor's rate of return on convertable bond
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Program 3 continued

```
                00280  ;
                00290  ; CONSTANTS:
FFB3  8F        00300    CURSOR  DEFB 8FH    ; USER SELECTABLE
FFB4  0A        00310    LIMIT   DEFB 10     ; USER SELECTABLE
                00320  ; END CONSTANTS.
                00330  ;
                00340  ; VARIABLES:
FFB5  00        00350    CMODE   DEFB 00  ; CURSOR ON/OFF TOGGLE
FFB6  00        00360    COUNT   DEFB 00  ; ISR CALL COUNTER
                00370  ; END VARIABLES.
                00380  ;
                00390  ;
                00400  ; INTERUPT SERVICE ROUTINE:
FFB7  E5        00410    ISR     PUSH HL     ; SAVE ACTIVE REGISTERS
FFB8  C5        00420            PUSH BC     ;  ON STACK.
FFB9  F5        00430            PUSH AF     ;
FFBA  3A E0 37  00440            LD   A,(37E0H) ;GET ISR LATCH STATUS
FFBD  CB 77     00450            BIT  6,A    ; CHECK FLOPPY DISK REQST
FFBF  20 33     00460            JR   NZ,FDC ; IF BIT 6=1
FFC1  CB 7F     00470            BIT  7,A    ; CHECK REAL TIME CLOCK
FFC3  28 32     00480            JR   Z,XIT ; IF BIT 7<>1
FFC5  3A B6 FF  00490    BLINK   LD   A,(COUNT) ; GET LAST COUNT
FFC8  3C        00500            INC  A          ; BUMP IT
```

Listing 4.

```
FF90            00140            ORG  0FF90H ; CHANGE AS NECESSARY
                00150  ;
                00160  ; PATCH LINK INITIALIZATION:
                00170  ;
FF90  F3        00180    LINKB   DI          ; DISABLE INTERUPTS
FF91  ED 56     00190            IM   1      ; INTERUPT MODE 1
FF93  3E C3     00200            LD   A,0C3H ; GET JUMP CODE BYTE
FF95  32 12 40  00210            LD   (4012H),A  ; STORE IT AT RST 38H
FF98  21 A4 FF  00220            LD   HL,ISR ; GET INTERUPT SERV. ADDRS
FF9B  22 13 40  00230            LD   (4013H),HL ;STORE IT AT RST 38H+1
FF9E  FB        00240            EI              ; START BLINKING NOW
FF9F  C3 72 00  00250            JP   0072H  ; BACK TO BASIC!
                00260  ;
                00270  ; SYSTEM VARIABLES  ETC:
                00280  ;
                00290  ; CONSTANTS:
FFA2  8F        00300    CURSOR  DEFB 8FH  ; BLOCK CURSOR
                00310  ; END CONSTANTS.
                00320  ;
                00330  ;
                00340  ; VARIABLES:
FFA3  00        00350    COUNT   DEFB 00  ; BLINK STATUS  ETC
                00360  ; END VARIABLES.
                00370  ;
                00380  ;
                00390  ; INTERUPT SERVICE ROUTINE:
FFA4  E5        00400    ISR     PUSH HL      ; SAVE ACTIVE REGISTERS
FFA5  F5        00410            PUSH AF      ;   ON STACK.
FFA6  3A E0 37  00420            LD   A,(37E0H) ; GET ISR LATCH STATUS
FFA9  CB 77     00430            BIT  6,A  ;CHECK FLOPPY DISK RQST
FFAB  20 2F     00440            JR   NZ,FDC  ; IF BIT 6 = 1
FFAD  CB 7F     00450            BIT  7,A     ; CHECK REAL TIME CLOCK
FFAF  28 2E     00460            JR   Z,XIT   ; IF BIT 7 <> 1
FFB1  3A A3 FF  00470    BLINK   LD   A,(COUNT) ; GET LAST COUNT
FFB4  3C        00480            INC  A        ; BUMP IT
FFB5  32 A3 FF  00490            LD   (COUNT),A ; PUT IT BACK
FFB8  CB 5F     00500            BIT  3,A      ; TEST A = 8
FFBA  28 1E     00510            JR   Z,JUMP   ; IF A<>8, THEN ...
FFBC  CB 9F     00520            RES  3,A  ; ELSE RESET COUNTER
FFBE  32 A3 FF  00530            LD   (COUNT),A ; PUT COUNTER BACK
FFC1  CB 7F     00540            BIT  7,A     ; MODE = OFF [0]?
FFC3  28 09     00550            JR   Z,TURNON ; IF SO, CHANGE MODE
FFC5  CB BF     00560            RES  7,A     ; ELSE MODE = ON [1]
FFC7  32 A3 FF  00570            LD   (COUNT),A ; SET MODE = OFF
FFCA  3E 20     00580            LD   A,20H  ; GET CURSOR OFF CHAR
FFCC  18 08     00590            JR   SETIT; GO AND STORE CHAR@(CURSOR)
FFCE  CB FF     00600    TURNON  SET  7,A    ; MODE = OFF, SO TURN ON
FFD0  32 A3 FF  00610            LD   (COUNT),A ; SET MODE
FFD3  3A A2 FF  00620            LD   A,(CURSOR) ; GET CURSOR ON CHAR
FFD6  2A 20 40  00630    SETIT   LD   HL,(4020H) ; GET CURSOR LOCATION
FFD9  77        00640            LD   (HL),A      ; STORE CHAR
FFDA  18 03     00650    JUMP    JR   XIT       ; RETURN FROM INTERUPT
FFDC  3A EC 37  00660    FDC     LD   A,(37ECH) ; RESET FDC LATCH
FFDF  3A E0 37  00670    XIT     LD   A,(37E0H) ; RESET LATCH
FFE2  F1        00680            POP  AF        ; GET WORKING REGISTERS
FFE3  E1        00690            POP  HL        ;   BACK FROM STACK
FFE4  FB        00700            EI        ; MAKE SURE CLOCK = ON
FFE5  C9        00710            RET       ; RETURN TO SYSTEM
                00720  ;
                00730  ;
FFE6            00740    ENDPRG  EQU  $
0056            00750    BYTES   EQU  ENDPRG-LINKB
                00760  ;
FF90            00770            END  LINKB ; AUTO-START HERE
                00780  ;
                00790  ;
                00800  ;
```

```
FFC9  47        00510            LD   B,A   ; MOVE TO B
FFCA  3A B4 FF  00520            LD   A,(LIMIT) ; GET UPPER LIMIT IN A
FFCD  90        00530            SUB  B      ; [A-B] LIMIT-COUNT
FFCE  78        00540            LD   A,B   ; GET COUNT BACK
FFCF  32 B6 FF  00550            LD   (COUNT),A ; STORE IT
FFD2  20 1E     00560            JR   NZ,JUMP ;IF MAX LIMIT NOT REACHED
FFD4  AF        00570            XOR  A          ; ZAP ACC
FFD5  32 B6 FF  00580            LD   (COUNT),A ; ZAP COUNT
FFD8  3A B5 FF  00590            LD   A,(CMODE);GET CURSOR MODE SETTING
FFDB  FE 00     00600            CP   0          ; MODE = OFF ?
FFDD  28 08     00610            JR   Z,TURNON ; IF SO, CHANGE MODE
FFDF  AF        00620            XOR  A          ; ZAP ACC
FFE0  32 B5 FF  00630            LD   (CMODE),A ; SET MODE = OFF
FFE3  3E 20     00640            LD   A,20H      ; CURSOR OFF CHAR
FFE5  18 07     00650            JR   SETIT  ; GO AND STORE CHAR@CURSOR
FFE7  3C        00660    TURNON  INC  A         ; MODE = OFF, SO TURN ON
FFE8  32 B5 FF  00670            LD   (CMODE),A ; SET MODE=OFF+1=ON
FFEB  3A B3 FF  00680            LD   A,(CURSOR) ; GET CURSOR ON CHAR
FFEE  2A 20 40  00690    SETIT   LD   HL,(4020H) ; GET CURSOR LOCATION
FFF1  77        00700            LD   (HL),A      ; STORE CHAR
FFF2  18 03     00710    JUMP    JR   XIT         ; RETURN FROM INTERUPT
FFF4  3A EC 37  00720    FDC     LD   A,(37ECH) ; RESET FLOPPY DISK
FFF7  3A E0 37  00730    XIT     LD   A,(37E0H) ; RESET REAL TIME LATCH
FFFA  F1        00740            POP  AF          ; RESTORE ACTIVE
FFFB  C1        00750            POP  BC          ; WORKING REGISTERS
FFFC  E1        00760            POP  HL          ; FROM STACK.
FFFD  FB        00770            EI       ; ENABLE INTERUPTS ANYWAY
FFFE  C9        00780            RET      ; BACK TO THE SALT MINE!!!
                00790  ;
                00800  ;
FFFF            00810    ENDPRG  EQU  $
005E            00820    BYTES   EQU  ENDPRG-LINKB
                00830  ;
FFA1            00840            END  LINKB ; AUTO-START HERE
```

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TYPING PRACTICE

Georgia A. Lawrence

Enthusiastic youngsters rush to personal computers to learn programming skills or to play games. The facility with which these youngsters accept the computers is hampered only by their lack of typing skills. Others, a little past the age of youngsters, find the computers mysterious and unapproachable. Many of these people know how to type, but a refresher course in typing would help them become more comfortable when using computers.

The computer itself is the obvious teaching machine to provide a lesson in typing skills. "Typing Practice" starts out by asking what level of difficulty the typist (or the would-be typist) wishes to use. The letters of the preferred level of difficulty are displayed on the television screen. If the letters are typed correctly, "100%" is printed on the screen, accompanied by the sound of bells. If mistakes are made, a buzzer sounds and corrections are listed.

A few typing reminders for beginners: Difficulty level number one emphasizes the home keys on the typewriter. The fingers rest on the ASDF and JKL; keys, and the thumbs rest on the space bar. Level one also includes the letters E and I for practice. The next levels of difficulty move the fingers to the keys adjacent to the home keys. The typist should keep his eyes on the television screen, not on the keyboard. A book from the library could provide more helpful hints for beginners.

If the letters are typed correctly, "100%" is printed on the screen, accompanied by the sound of bells.

This typing program was written in Applesoft Basic for the Apple II Plus and should be adaptable to other systems.

Line 115 of the program instructs the typist to leave no spaces between letters or at the end of the group of letters because the program checks the input in this format. Line 120 permits the typist to choose the level of difficulty from beginner level one to advanced levels six and seven. Lines 150-260 choose a random number from the subroutines. This letter and the next three letters are put into a string. The order of the letters will be rearranged every time one level of difficulty is repeated. Many repetitions of each level will improve typing ability.

Line 270 prints the letters to be typed, and line 290 calls for the input from the typist. Line 300 combines the group of strings to one string to make checking for accuracy easier. Line 305 reminds the programmer to add the bell over the exclamation marks in line 310 to make the program more fun.

Line 310 checks the input for typing accuracy. Perfect typing receives a 100% score. Line 320 checks for mistakes and line 330 gives the sound of the buzzer designating errors. Line 350 displays the mistakes and the corrections.

Line 380 keeps the typist at the same level of difficulty because he made typing mistakes. Lines 390-420 permit the typist who makes no mistakes to choose between typing more of the same level of difficulty or going to an advanced level.

Lines 450-720 are the subroutines which assign letters for the different levels of difficulty.

Learning to type with this program will, we hope, be fun and easy for youngsters who already enjoy computers. For those who approach computers with caution and timidity, we hope that re-learning to type will change a distraction into an attraction. ☐

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CIRCLE 222 ON READER SERVICE CARD

Typing, continued...

```
 100  REM  THIS IS TYPING PRACTICE

 104  REM  PROGRAM BY G A LAWRENCE

 105  HOME : PRINT "THIS IS TYPING
       PRACTICE."
 110  PRINT : PRINT "TYPE THE LETT
      ERS IN ONE LINE WITH "
 115  PRINT "NO SPACES BETWEEN LET
      TERS.": PRINT
 120  PRINT "WHAT LEVEL OF DIFFICU
      LTY? (1-7)";: GET DF: PRINT
      DF
 130  ON DF GOSUB 450,490,530,570,
      610,650,690
 140  PRINT
 150  LET X =  INT (5 *  RND (1) +
      1)
 160  LET X$ =  MID$ (A$,X,3)
 170  LET Y =  INT (5 *  RND (1) +
      1)
 180  LET Y$ =  MID$ (B$,Y,3)
 190  LET Z =  INT ( RND (1) * 5) +
      1
 200  LET Z$ =  MID$ (C$,Z,3)
 210  LET Q =  INT (5 *  RND (1) +
      1)
 220  LET Q$ =  MID$ (G$,Q,3)
 230  LET K =  INT (5 *  RND (1) +
      1)
 240  LET K$ =  MID$ (E$,K,3)
 250  LET V =  INT (5 *  RND (1) +
      1)
 260  LET V$ =  MID$ (H$,V,3)
 270  PRINT X$;Y$,K$;Q$,Z$;V$,
 280  PRINT : PRINT
 290  INPUT T$
 300 WR$ = X$ + Y$ + K$ + Q$ + Z$ +
      V$
 305  REM  ADD BELL ON TOP OF EXCL
      AMATION MARKS IN LINE 310
 310  IF T$ = WR$ THEN  PRINT : PRINT
      "YOU SCORED 100%. VERY GOOD!
      !!": GOTO 390
 320  IF T$ <  > WR$ THEN 330
 330  PRINT : PRINT "OOPS!!":S =  -
      16336: FOR JJ = 1 TO 55:B =
       PEEK (S):SOUND = B + B: NEXT
      JJ: PRINT
 340  FOR X = 1 TO 18 STEP 3
 350  INVERSE : IF  MID$ (T$,X,3) <
       >  MID$ (WR$,X,3) THEN  PRINT
       MID$ (T$,X,3);: NORMAL : PRINT
      " SHOULD BE ";: INVERSE : PRINT
       MID$ (WR$,X,3);: NORMAL : PRINT
      " ": PRINT
 360  NORMAL
 370  NEXT X
```

```
 380  PRINT : PRINT "TRY THESE LET
      TERS AGAIN.": FOR I = 1 TO 1
      000: NEXT I: GOTO 140
 390  PRINT : PRINT "WOULD YOU LIK
      E THE SAME LETTERS AGAIN?";:
       GET MM$: PRINT : IF MM$ = "
      Y" THEN 140
 400  IF MM$ = "N" THEN 410
 410  PRINT : PRINT "WOULD YOU LIK
      E DIFFERENT LETTERS?";: GET
      TY$: PRINT
 420  IF TY$ = "Y" THEN  PRINT : GOTO
      120
 430  IF TY$ = "N" THEN  END
 440  END
 450  PRINT
 460 A$ = "ASDFI":B$ = "EJKL;":C$ =
      "SEFIA"
 470 E$ = "EK;DI":G$ = "SEJLI":H$ =
      "FSDAJ"
 480  RETURN
 490  PRINT
 500 A$ = "RIJUA":B$ = "DEKAI":C$ =
      "FREUS"
 510 E$ = "LUARD":G$ = "SRFUI":H$ =
      "JIL;E"
 520  RETURN
 530  PRINT
 540 A$ = "SIJUH":B$ = "HYKEG":C$ =
      "URLIT"
 550 E$ = "FGTUD":G$ = "GEYRI":H$ =
      "HTREY"
 560  RETURN
 570  PRINT
 580 A$ = "YAHRW":B$ = "QSJIP":C$ =
      "WOKUQ"
 590 E$ = "OWPFL":G$ = "PEGTO":H$ =
      "DORWQ"
 600  RETURN
 610  PRINT
 620 A$ = "JVAPU":B$ = "TBINQ":C$ =
      "YMDML"
 630 E$ = "QVFBN":G$ = "WBGME":C$ =
      "ONHVR"
 640  RETURN
 650  PRINT
 660 A$ = "ZU/PX":B$ = "KTSVC":C$ =
      "XYDB."
 670 E$ = "EQFN/":G$ = "IWCMZ":H$ =
      "XOHZC"
 680  RETURN
 690  PRINT
 700 A$ = "2S28K":B$ = "K83D3":C$ =
      "D3J7J"
 710 E$ = "7JF4F":G$ = "9L9F5":C$ =
      "J6J;O"
 720  RETURN
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Typing, continued...

```
 100  REM  THIS IS TYPING PRACTICE

 104  REM  PROGRAM BY G A LAWRENCE

 105  HOME : PRINT "THIS IS TYPING
        PRACTICE."
 110  PRINT : PRINT "TYPE THE LETT
      ERS IN ONE LINE WITH "
 115  PRINT "NO SPACES BETWEEN LET
      TERS.": PRINT
 120  PRINT "WHAT LEVEL OF DIFFICU
      LTY? (1-7)";: GET DF: PRINT
      DF
 130  ON DF GOSUB 450,490,530,570,
      610,650,690
 140  PRINT
 150  LET X =  INT (5 *  RND (1) +
      1)
 160  LET X$ =  MID$ (A$,X,3)
 170  LET Y =  INT (5 *  RND (1) +
      1)
 180  LET Y$ =  MID$ (B$,Y,3)
 190  LET Z =  INT ( RND (1) * 5) +
      1
 200  LET Z$ =  MID$ (C$,Z,3)
 210  LET Q =  INT (5 *  RND (1) +
      1)
 220  LET Q$ =  MID$ (G$,Q,3)
 230  LET K =  INT (5 *  RND (1) +
      1)
 240  LET K$ =  MID$ (E$,K,3)
 250  LET V =  INT (5 *  RND (1) +
      1)
 260  LET V$ =  MID$ (H$,V,3)
 270  PRINT X$;Y$,K$;Q$,Z$;V$,
 280  PRINT : PRINT
 290  INPUT T$
 300 WR$ = X$ + Y$ + K$ + Q$ + Z$ +
      V$
 305  REM  ADD BELL ON TOP OF EXCL
      AMATION MARKS IN LINE 310
 310  IF T$ = WR$ THEN  PRINT : PRINT
      "YOU SCORED 100%. VERY GOOD!
      !!": GOTO 390
 320  IF T$ <  > WR$ THEN 330
 330  PRINT : PRINT "OOPS!!":S =  -
      16336: FOR JJ = 1 TO 55:B =
       PEEK (S):SOUND = B + B: NEXT
      JJ: PRINT
 340  FOR X = 1 TO 18 STEP 3
 350  INVERSE : IF  MID$ (T$,X,3) <
       >  MID$ (WR$,X,3) THEN  PRINT
       MID$ (T$,X,3);: NORMAL : PRINT
      " SHOULD BE ";: INVERSE : PRINT
       MID$ (WR$,X,3);: NORMAL : PRINT
      " ": PRINT
 360  NORMAL
 370  NEXT X
 380  PRINT : PRINT "TRY THESE LET
      TERS AGAIN.": FOR I = 1 TO 1
      000: NEXT I: GOTO 140
 390  PRINT : PRINT "WOULD YOU LIK
      E THE SAME LETTERS AGAIN?";:
       GET MM$: PRINT : IF MM$ = "
      Y" THEN 140
 400  IF MM$ = "N" THEN 410
 410  PRINT : PRINT "WOULD YOU LIK
      E DIFFERENT LETTERS?";: GET
      TY$: PRINT
 420  IF TY$ = "Y" THEN  PRINT : GOTO
      120
 430  IF TY$ = "N" THEN  END
 440  END
 450  PRINT
 460 A$ = "ASDFI":B$ = "EJKL;":C$ =
      "SEFIA"
 470 E$ = "EK;DI":G$ = "SEJLI":H$ =
      "FSDAJ"
 480  RETURN
 490  PRINT
 500 A$ = "RIJUA":B$ = "DEKAI":C$ =
      "FREUS"
 510 E$ = "LUARD":G$ = "SRFUI":H$ =
      "JIL;E"
 520  RETURN
 530  PRINT
 540 A$ = "SIJUH":B$ = "HYKEG":C$ =
      "URLIT"
 550 E$ = "FGTUD":G$ = "GEYRI":H$ =
      "HTREY"
 560  RETURN
 570  PRINT
 580 A$ = "YAHRW":B$ = "QSJIP":C$ =
      "WOKUQ"
 590 E$ = "OWPFL":G$ = "PEGTO":H$ =
      "DORWQ"
 600  RETURN
 610  PRINT
 620 A$ = "JVAPU":B$ = "TBINQ":C$ =
      "YMDML"
 630 E$ = "QVFBN":G$ = "WBGME":C$ =
      "ONHVR"
 640  RETURN
 650  PRINT
 660 A$ = "ZU/PX":B$ = "KTSVC":C$ =
      "XYDB."
 670 E$ = "EQFN/":G$ = "IWCMZ":H$ =
      "XOHZC"
 680  RETURN
 690  PRINT
 700 A$ = "2S28K":B$ = "K83D3":C$ =
      "D3J7J"
 710 E$ = "7JF4F":G$ = "9L9F5":C$ =
      "J6J;0"
 720  RETURN
```

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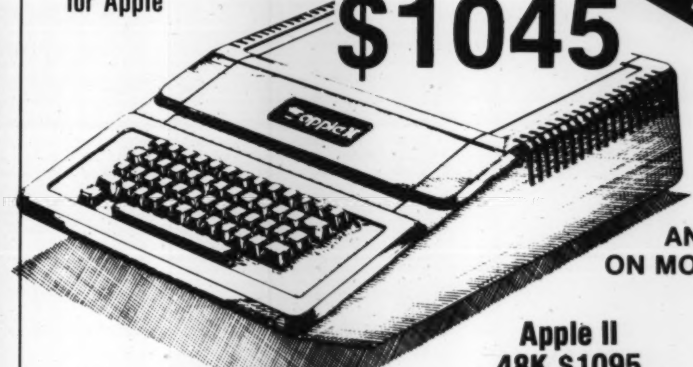

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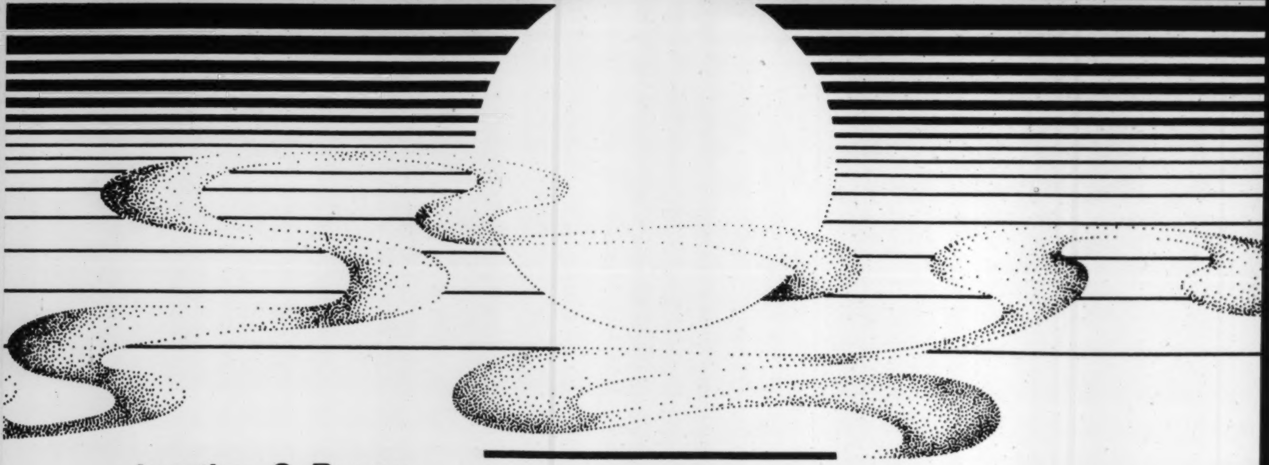

Jonathan C. Barron

An annuity is a finite sequence of equal periodic payments such as mortgage payments, installment payments or rent payments. We assume that these payments earn interest at a given rate compounded at a given frequency per year. There are two important values associated with an annuity: the value of the annuity at the present time, called the present value, and the value at some future time, called the future value.

The future value of an annuity is given by the formula

$$S=R((1+I)**N-1)/I$$

where S=the future value
I=the interest rate per conversion period
N=the number of conversion periods
R=the periodic payment

If R=\$1, then S=((1+I)**N-1)/I which is known as the future value of \$1 per period. In the parlance of the mathematics of finance, the quantity is called "S sub N angle I". When R#\$1, then S/R equals the future value of \$1 per period.

The purpose of this paper is to explain a mathematical technique for solving for the interest rate, I, given the other variables S, N, and R, and to develop a computer program to implement the technique. The reason a special technique is needed follows from the fact that there is no explicit way to solve for I in equation (1).

> ***The first step is to make an initial guess at the solution. It does not matter what the initial guess is; the method will create a sequence which converges to a solution.***

Thus we use an approximating technique known as the method of successive approximation by interval halving.

Before going into the details of how we propose to solve this problem, let's examine equation (1) more closely. Let C=S/R, then equation (1) may be written as

$$C=((1+I)**N-1)/I$$

using the binomial expansion we write

$$C=\left[\sum_{R=1}^{N}\binom{N}{R}I**R-1\right]/I$$

or $P(I)=0$

where $$P(I)=\sum_{R=1}^{N}\binom{N}{R}I**(R-1)-C=$$

$$\sum_{R=2}^{N}\binom{N}{R}I**(R-1)+N-C \qquad (2)$$

Since this problem originated from a study of annuities we are able to make the following observations.

1. 0<I<=1 due to the fact that I is a percentage less than 100%.

2. There are definitely N payments of R dollars, therefore the value of S would be at least equal to N times R. It follows that S>N*R or C >N, hence N-C<0. Thus, the constant term in the polynomial P(I) is negative, and the remaining coefficients are positive. This implies, by Decartes Rule of Signs, that there can be at most one real positive root. It also implies, for example, that it is impossible to have an annuity for which three payments of \$3000 would result in a future value of \$6000 (S=6000 N*R=3*(3000)=9000).

3. The derivative of P(I) equals

$$P'(I)=\sum_{R=2}^{N}(R-1)\binom{N}{R}I**(R-2)$$

which is clearly positive for all positive I. This means that P(I) is monotonically increasing for positive I.

4. P(0)=N-C<0, hence there is exactly one real positive root. That is, P(I) starts out less than zero and increases as I increases forcing it to assume the value of zero for some positive I.

5. If I=1, then

$$P(1)=2**N-1-C$$

If P(1) were less than zero, then it would follow from the above items that there is no

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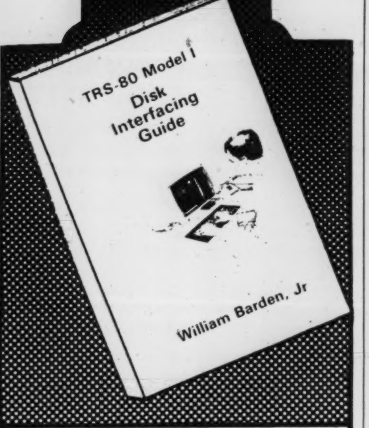

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solution less than one. Hence, C=S/R must be less than 2**N-1. For example, three payments of $1000 could not produce a future value of $8000 (S/R=8 2**N-1 =7) unless the interest rate is greater than 100% which is unlikely.

Let us begin with a general explanation of the interval halving method for approximating a root of a polynomial, P(X), which has at least one real root.

The first step is to make an initial guess at the solution. It does not matter what the initial guess is; the method will create a sequence which converges to a solution. We denote the initial guess as X0. We evaluate P(X0) and suppose P(X0)>0. At this point it would be helpful to know something about the nature of P(X) in order to decide if X should be increased from X0 or decreased from X0. What we are looking for are two values for which P(X) differs in sign. Since the nature of the function to which we intend to apply this technique is such that it increases as X increases, we will assume for this discussion that we keep decreasing the argument, X, by dividing by two until we find a change in the sign of P(X). Thus, we evaluate P(X) at X0/2. If the sign is still positive, we try X0/4 and so on until P(X) changes sign.

Suppose we find two values of X, say A and B, such that P(A)>0 and P(B)<0. Then since we are dealing with a continuous function, the solution of our problem lies between A and B. Next we compute P(X) at the midpoint of the segment between A and B. The midpoint is M=(A+B)/2. If P(M) is the same sign as P(A), then the solution is between M and B, otherwise the solution is between M and A. For this discussion, let us assume that P(X) changes sign between M and B. We focus our attention on the midpoint of the segment between M and B and repeat the process. At each stage of the process, we choose the interval over which P(X) changes sign. The sequence of midpoints obviously converges to the solution of the problem since at each stage the interval containing the solution becomes smaller. In fact, when the length of this interval becomes smaller than some predetermined value we accept the latest midpoint as the solution.

Now, let us apply this technique, using a computer, to the problem of finding the interest rate given the future value, the number of payments, and the value of the payment in an annuity problem. The program we will develop for this will be divided into several sections or modules each of which is a subroutine designed to handle a different part of the solution. This program was written for the Alphamicro 100 computer which permits the use of labels for sections of a program. These labels may be used in GOTO and GOSUB statements rather than line numbers. Those users who do not have the label capability may use line numbers and convert the label statements into remarks.

The first module is as follows:

```
100 VARIABLES:

110      INPUT"ENTER THE FUTURE
         VALUE:   ";FUTVAL

120      INPUT"ENTER THE NUMBER OF
         PAYMENTS:   ";NUM

130      INPUT"ENTER AMOUNT OF EACH
         PAYMENT:   ";PAY

140      INPUT"ENTER THE NUMBER OF
CONVERSION PERIODS PER YEAR: ";CONV

150      REM SNI=THE FUTURE VALUE OF
    $1 PER PERIOD FOR THE

160      REM UNKNOWN INTEREST RATE
   I-SHORT FOR 'S SUB N ANGLE I'

170      SNI=FUTVAL/PAY

180      IF SNI<NUM OR SNI>2**NUM-1
   PRINT"INVALID ":GOTO VARIABLES

190 RETURN
```

Clearly, this module is used to enter the known value of the variables and to check to see if they are valid as explained in items 2 and 5 above. It should be clear that in equation (1), S is replaced by FUTVAL, N by NUM and R by PAY. Since the Alphamicro permits variable names of any length, we use variable names that suggest to the reader what they represent. This brings us to our second module.

```
200 INITIAL'GUESS:

210 '    I=.1:ZZZ=I

220      GOSUB FUTURE'VALUE

230      DIFF=SNI-FNA

240      S=SGN(DIFF)

250 RETURN
```

In this module, we compute the future value of $1 for the unknown interest rate I. We make an initial guess at I in line 210 and we set ZZZ equal to I so that we may pass this value to the subroutine. Our guess is 10%, but actually the initial guess could be any value. However, the solution we seek is less than 100%. The subroutine FUTURE'VALUE is used to find the future value of $1, denoted by FNA, for the initial guess. If your system has user defined functions, then this task could be handled by means of a user defined function. The subroutine returns the value of FNA needed in line 230. DIFF is the difference between the future value of $1 for the unknown I and the future value of $1 for the initial guess, and S is the sign of DIFF which is 1 if DIFF is greater than zero, 0 if DIFF equals zero, and -1 if DIFF is less than zero.

The purpose of the third module is explained by its name.

```
300 FIRST'SIGN'CHANGE:

310      J=I

315      IF S=-1 GOTO 330

320      I=2*I:ZZZ=I
```

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```
325       GOTO 335
330       I=I/2:ZZZ=I
335       GOSUB FUTURE'VALUE
340       DIFF=SNI-FNA
345       U=SGN(DIFF)
350       IF U=S GOTO 310
355       D=I
360 RETURN
```

At this point, it should be noted that

```
FNA=[(1+I)**N-1]/I
```

is a monotonically increasing function for all I greater than zero and continuous for all nonzero I. Consequently, if DIFF for the initial guess is less than zero, i.e., S=-1, then we should decrease I and check again. The computer decreases I by dividing by 2 in line 330. If the initial DIFF is greater than zero (S=1) we should increase I (line 320) and compute DIFF again. As long as there is no sign change (line 350), we store this value of I as variable J (line 310) and repeat the process. When a sign change has been found, then one value will be denoted by J and the other by I. In other words, I and J are the end points of an interval containing the solution. We are now ready to begin the interval halving process which brings us to the next module.

```
400 INTERVAL'HALVING:
410       IF ABS(I-J)<1.E-06 RETURN
420       D=(I+J)/2:ZZZ=D
430       GOSUB FUTURE'VALUE
440       DIFF=SNI-FNA
450       Z=SGN(DIFF)
460       IF Z=U THEN 490
470       J=D
480       GOTO 410
490       I=D
495       GOTO 410
```

We begin the interval halving process by checking how close I and J are numerically. If the distance between I and J is less than .000001 then we accept D as the solution. Just in case our initial guess is so good that I and J are already within the tolerance level set in line 410, we set D equal to I at the end of the previous module (line 355). When we study the output module the reason for this will be clear. If I and J are not within the tolerance, we let D be the midpoint between I and J (line 420). Next, the computer computes the future value of $1 (line 430) and computes a new difference (line 440) and its sign (line 450). Recall now that U is the sign of the future value of $1 for the value of I which produced the first sign change. If DIFF for the new value has the same sign then we keep J fixed and replace I with D (line 490). Otherwise, we leave I fixed and replace J with D (line 470). The computer then checks if these values are within the tolerance and repeats the process if they are not. This process will continue until I and J are within the given distance of each other, then the solution and D will be within the same distance so that we may accept D as the solution with an error no greater than .000001.

The reader can see at a glance how the program is organized.

To learn the result of the interval halving process we use the next module.

```
500 OUTPUT:
510       PRINT USING"RATE PER PERIOD
          ##.### %";D*100
520       PRINT USING"NOMINAL RATE
          ###.### %";CONV*D*100
530       ZZZ=D
540       GOSUB FUTURE'VALUE
550       PRINT USING "FUTURE VALUE
     FOR THIS RATE #####.## ";PAY*FNA
560 RETURN
```

The output module needs little explanation. Line 550 provides a check of how good our program has estimated the rate I.

Our last module brings the program to an orderly conclusion. Any necessary 'cleanup' operations are reserved for this module such as the closing of files if any were used or printing out any special messages. Line 620 provides the user with the opportunity to run another set of data without starting another run.

```
600 ENDIT:
610       PRINT "JOB COMPLETE!"
620       INPUT"WOULD YOU LIKE
   ANOTHER RUN (0=NO,1=YES)? ";ANS
630       IF ANS<>0 GOTO VARIABLES
640 END
```

The main module consists of a series of GOSUB statements which control the execution of the program. One may argue that this is unnecessary since the program is basically a "straight-through" or "top-to-bottom" type of program. I chose this method because I think that it makes the program easier to read. The reader can see at a glance how the program is organized and how the method of successive approximations is carried out by the computer. Also, it makes the program easy to modify. This program can be easily modified to find the yield rate of a bond.

```
10    MAIN:
20          GOSUB VARIABLES
30          GOSUB INITIAL'GUESS
40          GOSUB FIRST'SIGN'CHANGE
50          GOSUB INTERVAL'HALVING
60          GOSUB OUTPUT
70          GOTO ENDIT
```

We conclude with the FUTURE' VALUE subroutine.

```
700 FUTURE'VALUE:
710       FNA=((1+ZZZ)**NUM-1)/ZZZ
720 RETURN
```

For the reader's convenience, here is a listing of the complete program:

```
 10  MAIN:
 20       GOSUB VARIABLES
 30       GOSUB INITIAL'GUESS
 40       GOSUB FIRST'SIGN'CHANGE
 50       GOSUB INTERVAL'HALVING
 60       GOSUB OUTPUT
 70       GOTO ENDIT
100 VARIABLES:
110       INPUT"ENTER THE FUTURE VALUF:    ";FUTVAL
120       INPUT"ENTER THE NUMBER OF PAYMENTS:    ";NUM
130       INPUT"ENTER AMOUNT OF EACH PAYMENT:    ";PAY
140       INPUT"ENTER THE NUMBER OF CONVERSION PERIODS PER YEAR: ";CONV
150       REM SNI=THE FUTURE VALUE OF $1 PER PERIOD FOR THE
160       REM UNKNOWN INTEREST RATE I-SHORT FOR 'S SUB N ANGLE I'
170       SNI=FUTVAL/PAY
```

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Successive Approximation, continued...

```
180     IF SNI<NUM OR SNI>2**NUM-1 PRINT"INVALID ":GOTO VARIABLES
190 RETURN
200 INITIAL'GUESS:
210     I=.1:ZZZ=I
220     GOSUB FUTURE'VALUE
230     DIFF=SNI-FNA
240     S=SGN(DIFF)
250 RETURN
300 FIRST'SIGN'CHANGE:
310     J=I
315     IF S=-1 GOTO 330
320     I=2*I:ZZZ=I
325     GOTO 335
330     I=I/2:ZZZ=I
335     GOSUB FUTURE'VALUE
340     DIFF=SNI-FNA
345     U=SGN(DIFF)
350     IF U=S GOTO 310
355     D=I
360 RETURN
400 INTERVAL'HALVING:
410     IF ABS(I-J)<1.E-06 RETURN
420     D=(I+J)/2:ZZZ=D
430     GOSUB FUTURE'VALUE
440     DIFF=SNI-FNA
450     Z=SGN(DIFF)
460     IF Z=U THEN 490
470     J=D
480     GOTO 410
490     I=D
495     GOTO 410
500 OUTPUT:
510     PRINT USING"RATE PER PERIOD ##.### %";D*100
520     PRINT USING"NOMINAL RATE ###.### %";CONV*D*100
530     ZZZ=D
540     GOSUB FUTURE'VALUE
550     PRINT USING "FUTURE VALUE FOR THIS RATE #####.## ";PAY*FNA
560 RETURN
600 ENDIT:
610     PRINT "JOB COMPLETE!"
620     INPUT"WOULD YOU LIKE ANOTHER RUN (0=NO,1=YES)? ";ANS
630     IF ANS<>0 GOTO MAIN
640 END
700 FUTURE'VALUE:
710     FNA=((1+ZZZ)**NUM-1)/ZZZ
720 RETURN
```

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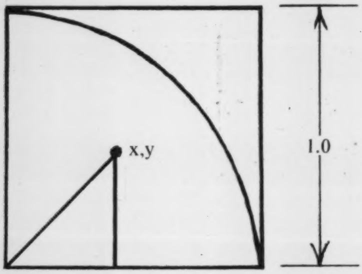
Pat G. Lowry

An Irrational Calculation of Pi

Pi is an irrational number. Here's the most irrational method for calculating it that we've seen yet.

I would like to add one more way to "calculate" pi to Jordan Mechner's interesting article on the subject *(Creative Computing,* May 1980). The method uses a monte carlo simulation based on the following diagram which shows a quarter circle of unit radius inscribed in a unit square.



Knowing the area of the circle relative to that of the square permits the value of pi to be found from the equation $A = \pi/4\ r^2$.

The area of the enclosed quarter circle can be found by "throwing darts" at the diagram using the RND(0) Basic random number generator and keeping track of the number of hits inside the circle relative to the number of throws. Pi is then found by multiplying the ratio of hits to throws by 4.

To decide whether a particular "throw" yields a point inside the circle, consider the coordinates of a random point x,y inside the unit square. If x and y are both random numbers between zero and one, then the point lies within the circle and is a hit whenever $x^2 + y^2 \leq 1$ (the radius of the circle). If $x^2 + y^2 > 1$ then the point lies outside the circle.

The following TRS-80 Level II Basic program suffices to obtain a fair approximation to π after about 100,000 throws. The variable called DRIFT is a measure of the closeness of the approximation at a given time. It represents the difference between the number of throws and its expected value based on the number of hits. The variables MAX DRIFT and MIN DRIFT represent the maximum and minimum values reached by DRIFT over the course of the simulation.

Incidentally, the Hindu value of π is better approximated by

$$\pi = 3927/1250 = 3.1416$$

rather than the value of $\pi = 3177/1250$ given. My favorite ratio expression for $\pi = 355/113$ which is accurate to better than one part in 100,000. □

Pat G. Lowry, 9010 Horton Road, Laurel, MD 20811.

```
10 GOTO 100
20 REM COMPUTATION OF PI BY MONTE CARLO SIMULATION
30 REM BY PAT G. LOWRY
40 REM 4/5/80
50 REM DATA DICTIONARY
60 REM ---------------
70 REM X   0<X<1
80 REM Y   0<Y<1
90 REM HITS  THE NUMBER OF THROWS INSIDE A UNIT CIRCLE
100 REM MISSES THE NUMBER OF THROWS OUTSIDE A UNIT CIRCLE
110 REM THROWS THE NUMBER OF RANDOM POINTS GENERATED
120 REM PI THE CURRENT ESTIMATE=4*HITS/THROWS
130 REM NP THE INTERVAL BETWEEN REPORTS
140 REM DR THE DRIFT: 4*HITS/PI-THROWS
150 REM DX THE MAXIMUM DRIFT -SO FAR
160 REM DN THE MINIUM DRIFT  - SO FAR
170 REM P4 A CONSTANT PI/4=355/113/4
180 REM --------------
190 REM  TOP LEVEL CONTROL
200 CLS : PRINT : PRINT
210 GOSUB 290 : REM ENTER THE PRINT INTERVAL
220 GOSUB 250 : REM INITIALIZATION
230 GOSUB 330
240 REM  INITIALIZATION
250 HITS=0 : MISSES=0 : THROWS=0 : DX=0 : DN=0 : P4=355/113/4
260 CLS : PRINT : PRINT : PRINT
270 PRINT "           SIMULATING PI"
280 RETURN
290 INPUT "  ENTER THE INTERVAL BETWEEN REPORTS";NP
300 CLS : RETURN
310 REM --------------
320 REM SIMULATE PI
330 FOR I=1 TO NP
340    X=RND(0) : Y=RND(0)
350     IF X*X+Y*Y>1 THEN MISSES=MISSES+1
360 NEXT I : THROWS=THROWS+NP
370 HITS=THROWS-MISSES
380 PI=4*HITS/THROWS
390 DR=HITS-P4*THROWS
400 IF DR>DX THEN DX=DR
410 IF DR<DN THEN DN=DR
420 REM --------------
430 REM    REPORT THE CURRENT VALUES
440 PRINT @ 320,"     THE MOST RECENT VALUES ARE:"
450 PRINT "         NO. HITS     =";HITS
460 PRINT "         NO. THROWS   =";THROWS
470 PRINT "         PI           =";PI
480 PRINT "         DRIFT        =";DR
490 PRINT "         MAX DRIFT    =";DX
500 PRINT "         MIN DRIFT    =";DN
510 GOTO 330
520 END
```

```
ENTER THE INTERVAL BETWEEN REPORTS ?1000
        SIMULATING PI


   THE MOST RECENT VALUES ARE:
        NO. HITS      = 778
        NO. THROWS    = 1000
        PI            = 3.112
        DRIFT         =-7.39826
        MAX DRIFT     = 0
        MIN DRIFT     =-7.39826




   THE MOST RECENT VALUES ARE:
        NO. HITS      = 1585
        NO. THROWS    = 2000
        PI            = 3.17
        DRIFT         = 14.2035
        MAX DRIFT     = 14.2035
        MIN DRIFT     =-7.39826




   THE MOST RECENT VALUES ARE:
        NO. HITS      = 2372
        NO. THROWS    = 3000
        PI            = 3.16267
        DRIFT         = 15.8852
        MAX DRIFT     = 15.8852
        MIN DRIFT     =-7.39826




   THE MOST RECENT VALUES ARE:
        NO. HITS      = 3145
        NO. THROWS    = 4000
        PI            = 3.145
        DRIFT         = 3.40698
        MAX DRIFT     = 15.8852
        MIN DRIFT     =-7.39826

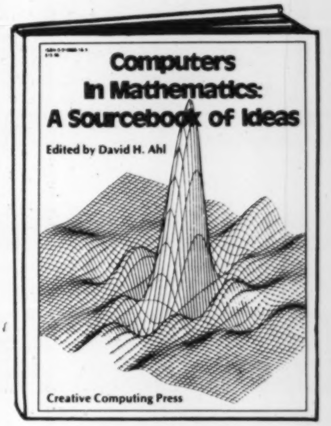



ENTER THE INTERVAL BETWEEN REPORTS ?10000
        SIMULATING PI


   THE MOST RECENT VALUES ARE:
        NO. HITS      = 7890
        NO. THROWS    = 10000
        PI            = 3.156
        DRIFT         = 36.0176
        MAX DRIFT     = 36.0176
        MIN DRIFT     = 0
```

Sourcebook of Ideas

Many mathematics ideas can be better illustrated with a computer than with a text book.



Consider Baseball cards. If there are 50 cards in a set, how many packs of bubble gum must be purchased to obtain a complete set of players? Many students will guess over 1 million packs yet on average it's only 329.

The formula to solve this problem is not easy. The computer simulation is. Yet you as a teacher probably don't have time to devise programs to illustrate concepts like this.

Between grades 1 and 12 there are 142 mathematical concepts in which the computer can play an important role. Things like arithmetic practice, X-Y coordinates, proving geometic theorems, probability, compounding and computation of pi by inscribed polygons.

Endorsed by NCTM

The National Council of Teachers of Mathematics has strongly endorsed the use of computers in the classroom. Unfortunately most textbooks have not yet responded to this endorsement and do not include programs or computer teaching techniques. You probably don't have the time to develop all these ideas either. What to do?

For the past six years, *Creative Computing* magazine has been running two or three articles per issue written by math teachers. These are classroom proven, tested ideas complete with flowcharts, programs and sample runs.

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Another section presents over 250 problems, puzzles, and programming ideas, more than are found in most "problem collection" books.

Computers in Mathematics: A Sourcebook of Ideas is edited by David Ahl, one of the pioneers in computer education and the founder of *Creative Computing.*

The book is not cheap. It costs $15.95. However if you were to order just half of the back issues from which articles were drawn, they would cost you over $30.

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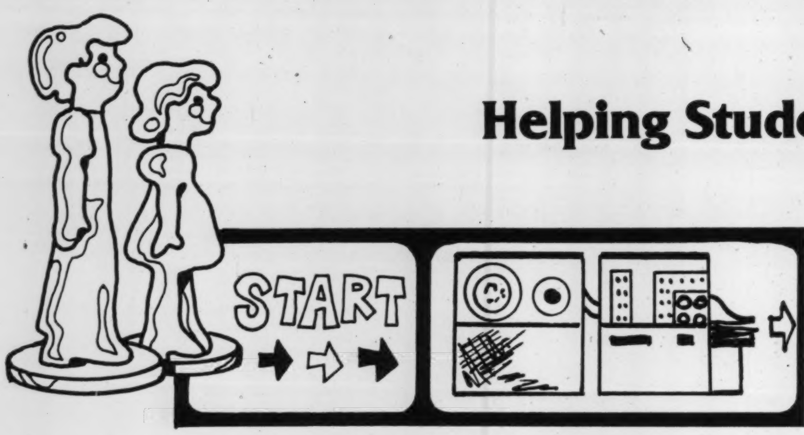

Helping Students Think About Marriage and Education

Mike Cuchna

Here's an automated sort of Monopoly game that helps kids think about the possible consequences of getting married and/or staying in school.

I am by profession a mathematics teacher and have taught for nine years at Merced High School, located in California's great Central Valley—a sleepy, dusty farmtown on the way to Yosemite—so said one reporter when President Carter stopped here for a Town Meeting. Recently I have developed several computer programs to enhance the mathematics curriculum, and at the same time introduce students and interested teachers to the computer world.

Only recently has sufficent computer hardware been available to accomplish more than a token effort in programming. Our school district over the course of three years has purchased one Sol-20 kit (first year), some boards, and one single drive Micropolis disk.

Since district funding is somewhat limited and many students are eager to use the machine, we have acquired, through the hard work of 25 Math Club members, one Commodore 8K PET. The acquisition of equipment has allowed inquisitive teachers and students to see, use and appraise the capabilities of these marvelous technological innovations.

One such instructor from the social studies department came to me with a request.

This teacher devotes the latter part of each school year to the topic of family life. In this unit students look at various life experiences and discuss the consequences of decisions leading to those experiences.

His current project was designed to help students understand career opportunities, and he hoped to develop curriculum materials that would help students consider their life objectives better.

Given the random selection of financial and family circumstances, as well as an occupation based on educational preference, the student writes a paper.

With the idea of introducing career education into his "family life" curriculum, and knowing we had two computers in the school, the teacher approached me about the possibility of developing a computer program that would relate the students' educational preferences to possible occupations and hypothetical family situations, randomly generated to cover the financial and personal circumstances besetting a family.

With possible future careers as yet unknown, his idea was for students to keep their options open in the face of advancing technology. To that end we spent, with one other teacher, several hours developing the format of presentation, content of choices, review of decision-making information and the mechanism of student interaction with the computer-generated responses.

After about four hours of writing the program—three hours for a student to enter the program and two hours of debugging (a little longer than anticipated)—out came the final program listing. Several revisions are planned for next year, principally the inclusion of a financial section based on expenses incurred by a family or individual—particularly fixed expenses—and voluntary or involuntary indebtedness associated with time payments. The program runs on both our Sol and our Commodore PET; however, due to memory limitations, the PET version is only a subset of the program presented here. Next year we hope to have two PETs each covering half of the total program. Currently the program requires approximately 12K of RAM in two main program sections, so we figure two PETs at 8K each should do us nicely.

Not only have about 400 students had an opportunity to interact with the computer, but the information provided was used as a stepping stone to stimulate student thought concerning education and family preference decisions and the possible consequences of those decisions.

The Program

Now let me present a narrative of the program in operation and a summary of the variables used.

First the instructor explains the content of the unit to be covered and the manner of presentation with all required and desired student outcomes. The students,

---

Mike Cuchna, 2942 El Camino Real, Merced, CA 95340.

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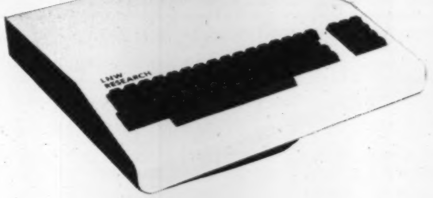

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FLOPPY DISK CONTROLLER	SINGLE/ DOUBLE	SINGLE	SINGLE/ DOUBLE
SERIAL RS232 PORT	YES	YES	YES
PRINTER PORT	YES	YES	YES
REAL TIME CLOCK	YES	YES	YES
24 X 80 CHARACTERS	YES	NO	NO
VIDEO MONITOR	YES	YES	YES
UPPER AND LOWER CASE	YES	OPTIONAL	YES
REVERSE VIDEO	YES	NO	NO
KEYBOARD	63 KEY	53 KEY	53 KEY
NUMERIC KEY PAD	YES	NO	YES
B/W GRAPHICS, 128 X 48	YES	YES	YES
HI-RESOLUTION B/W GRAPHICS, 480 X 192	YES	NO	NO
HI-RESOLUTION COLOR GRAPHICS (NTSC), 128 X 192 IN 8 COLORS	YES	NO	NO
HI-RESOLUTION COLOR GRAPHICS (RGB), 384 X 192 IN 8 COLORS	OPTIONAL	NO	NO
WARRANTY	6 MONTHS	90 DAYS	90 DAYS
TOTAL SYSTEM PRICE	$1,914.00	$1,840.00	$2,187.00
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on a worksheet designed for the purpose, enter an educational preference ranging from quitting high school to graduate studies. Second, the students make a choice regarding marital and family status. Thus equipped, they come to the computer (others have a reading assignment) and enter these three pieces of information.

The computer then goes through a selection process based on their input values. Occupations are presented to the student to view and choose based on his expected educational preference. The student then selects an occupational preference. The computer displays the occupation as well as salary range (figures based on 1978 estimates) and related occupations as a job cluster. The student copies this information down and presses the RETURN key to continue the program. Financial information, generated on a random basic, is then presented. The student is again asked to copy this information on the worksheet, and press the RETURN key for the final program segment.

Finally, the computer, based on student choice of family preference, presents two or three random family circumstances for the student to copy. It should be mentioned that particular effort was taken in the area of error trapping so that the program would run without the student being able to interrupt it. The information presented by the computer is used as a basis for a unit on decision making.

Given the random selection of financial and family circumstances, as well as an occupation based on educational preference, the student writes a paper. The papers are written on how to cope with the various situations and then used in class to develop discussion on various alternatives one might choose to overcome particular problems. ☐

Variable Summary Table:

J$ — used to read data statements on occupations and fate family circumstances
S$ — means of keeping displayed occupations page by page (a summary of J$ values displayed)
E$ — student choice of educational preference, used to present J$ values
F$ — student choice of family situations, used to present J$ values
G$ — refinement of family situation, used to determine number of fate family situations possible
R$ — student choice of occupation
Z$ — dummy variable to halt program until student is ready for next program section
K$ — replacement for J$ to keep circumstances from being duplicated
C — counter to place 10 occupations on the screen before page is cleared and next page presented
D — counter to keep track of page displayed
R — numerical value of R$
F — adjuster to compensate for page number and value of R$ (R) entered
X — counter for loop reading occupations
A1 — random number of financial situations to be presented
Z — loop counter for checking values of J$ (occupations) that match E$
Z1 — loop counter for financial circumstances
A2 — random choice of starting position in financial circumstance
A3 — used to insure that different financial circumstances are presented
A4 — used to insure that different financial circumstances are presented
Q3 — counter for family circumstance
Y5 — random number of family circumstances to be presented (2 or 3)
Y4 — random incrementer working with list of family circumstance
Y3 — random starting location in list of family circumstances
P1 — number of values from list of family circumstance to be used (21 or 35)
X9 — loop counter to match family circumstance F$ and value read J$

```
  10 REM*****************************************************
  15 REM*       WRITTEN BY  MIKE CUCHNA  APR 80             *
  20 REM*       PROCESSOR TECHNOLOGY EXTENDED CASSETTE BASIC  *
  25 REM*                                                   *
  30 REM*****************************************************
  50 DIM J$(45),K$(45),S$(400),H$(45)
 100 GOSUB 1010
 130 PRINT "PLEASE ENTER YOUR CHOICE OF EDUCATIONAL PREFERENCE:"
 140 PRINT TAB(10);"A - QUIT HIGH SCHOOL AT 16 AND ENTER THE JOB MARKET"
 150 PRINT TAB(10);"B - GRADUATE FROM HIGH SCHOOL AND ENTER JOB MARKET"
 160 PRINT TAB(10);"C - JOIN THE MILITARY AFTER HIGH SCHOOL"
 170 PRINT TAB(10);"D - GO TO A TRADE, TECHNICAL, OR JUNIOR COLLEGE"
 180 PRINT TAB(10);"E - GO TO AND COMPLETE A 4-YEAR COLLEGE PROGRAM"
 190 PRINT TAB(10);"F - COMPLETE GRADUATE STUDIES": PRINT
 195 CURSOR 12,1
 200 INPUT "YOUR CHOICE PLEASE THEN PRESS 'RETURN'  ",E$
 202 IF LEN(E$)>1 THEN 220
 205 IF E$="" THEN 220
 210 IF ASC(E$)>64 THEN 240
 220 PRINT "PLEASE ENTER A,B,C,D,E, OR F - DUMMY ": PAUSE 40
 230 GOTO 195
 240 IF ASC(E$)>70 THEN 220
 245 IF E$="F" THEN  LET E$="E"
 250 GOSUB 1010
 270 PRINT "PLEASE ENTER YOUR CHOICE OF FAMILY SITUTATION:"
 280 PRINT
 290 PRINT TAB(10);"YOU WILL:"
 300 PRINT TAB(15);"1 - NOT MARRY"
 310 PRINT TAB(15);"2 - LIVE TOGETHER WITH SOMEONE"
 320 PRINT TAB(15);"3 - MARRY BEFORE COMPLETING JOB PREPARATION"
 330 PRINT TAB(15);"4 - MARRY AFTER COMPLETING JOB PREPARATION"
 340 CURSOR 13,1
 380 INPUT "YOUR CHOICE FOR -A- (1 THRU 4) THEN PRESS 'RETURN' ",F$
 385 IF F$="" THEN 400
 390 IF ASC(F$)>48 THEN 420
 400 PRINT "PLEASE ENTER 1,2,3, OR 4 OK!! MEATBALL": PAUSE 40
 410 GOTO 340
 420 IF ASC(F$)>52 THEN 400
 421 GOSUB 1010
 422 PRINT TAB(10);"WILL YOU"
 424 PRINT TAB(15);"1 - HAVE CHILDREN"
 426 PRINT TAB(15);"2 - NOT HAVE CHILDREN"
 428 PRINT
 429 CURSOR 12,1
 430 INPUT "YOUR CHOICE FOR -B- (1 OR 2) THEN PRESS 'RETURN'",G$
 435 IF G$="" THEN 450
 440 IF ASC(G$)>48 THEN 470
 450 PRINT "PLEASE ENTER 1 OR 2 ONLY STUPID!!": PAUSE 40
 460 GOTO 429
 470 IF ASC(G$)>50 THEN 450
 480 GOSUB 1010
 485 PRINT "OCCUPATIONAL CHOICES BASED ON EDUCATIONAL PREPARATION"
 486 PRINT "ENTER -- A -- AND PRESS 'RETURN' TO START LIST AGAIN"
 490 LET C=0: LET D=0: LET S$="": RESTORE
 500 FOR X=1 TO 112
 510   READ J$
 520   FOR Z=1 TO 5
 525     IF X=112 THEN 580
 530     IF J$(Z,Z)<>E$ THEN 650
 535     LET C=C+1
 540     PRINT TAB(5);C;TAB(10);J$(6,20)
```

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Clear tabs from one to all.
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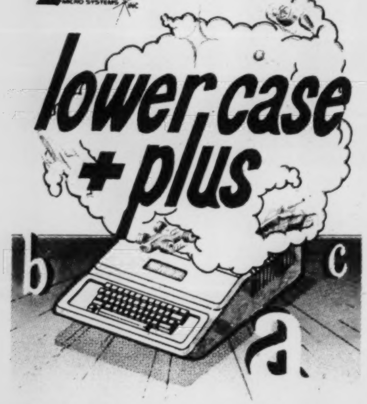

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Helping Students, continued...

```
545      LET S$=S$+J$(6,39)
560      IF C/10=INT(C/10) THEN 580
570      GOTO 650
580      PRINT "PLESE ENTER YOUR OCCUPATIONAL CHOICE AND"
590      INPUT "PRESS 'RETURN' OR PRESS 'RETURN' FOR THE NEXT PAGE",R$
605      IF R$="" THEN 635
606      IF R$="A" THEN  EXIT 480
615      IF ASC(R$)>57 OR ASC(R$)<48 THEN 580
616      IF VAL(R$)>C THEN 580
617      IF VAL(R$)<=0 THEN 580
618      IF VAL(R$)<C-9 THEN 580
620      LET R=VAL(R$): LET F=R-10*D: LET S$=S$(34*(F-1)+1,34*F)
630      EXIT 670
635      IF X=112 THEN  EXIT 662
640      LET D=D+1: LET S$="": PRINT "&K"
650    NEXT Z
660 NEXT X
662 PRINT "OK!! ONE MORE CHANCE - PICK A NUMBER - GET WITH IT!!": PAUSE 40: GOTO 480
670 GOSUB 1010
690 PRINT "YOUR CHOICE WAS:   ": PRINT
691 PRINT "   DESCRIPTION         PAY(X1000)   JOB CLUSTER"
695 PRINT "   ";S$(1,15);"   ";S$(16,24);"     ";S$(25,34)
700 CURSOR 13,1: INPUT "PRESS 'RETURN' TO CONTINUE",Z$
840 GOSUB 1010
850 PRINT "FATE HAS GIVEN YOU THE FOLLOWING FINANCIAL CIRCUMSTANCES"
855 PRINT "TO DEAL WITH:": PRINT
860 LET A1=INT(RND(0)*5+.5): IF A1<2 OR A1>3 THEN 860
870 FOR Z1=1 TO A1
880   LET A2=INT(RND(0)*50+1): IF A2>22 THEN 880
881   IF A3=A2 THEN 880: IF A4=A2 THEN 880
882   ON A2 GOTO 885,890,895,900,905,910,915,920,925,930,935,940,945,950,955,960,
      965,970,975,980 985,990
885   PRINT "MAJOR MEDICAL EXPENCES FOR AN OPERATION $5000": GOTO 1000
890   PRINT "YOUR FATHER DIES - INHERIT $20,000 - PAY 60% IN FUNERAL"
891   PRINT "EXPENSES AND INHERITANCE TAXES": GOTO 1000
895   PRINT "CAR TRANSMISSION NEEDS $350 REPAIR WORK": GOTO 1000
900   PRINT "TOO MANY TRAFFIC TICKETS - CAR INSURANCE CANCELLED": GOTO 1000
905   PRINT "YOU GET A COST OF LIVING RAISE OF 14%": GOTO 1000
910   PRINT "YOUR FOOD BILL INCREASES BY 10% OVER WHAT IT WAS": GOTO 1000
915   PRINT "GAS REACHES $2.50/GAL - TRANSPORTATION COSTS UP 15%": GOTO 1000
920   PRINT "YOUR RENT (HOUSE PAYMENT) INCREASES 5% EVERY SIX MONTHS": GOTO 1000
925   PRINT "YOUR UNION VOTES TO STRIKE - YOU LOSE 2 WEEKS WAGES": GOTO 1000
930   PRINT "INTEREST ON PERSONAL SAVINGS INCREASES TO 9%": GOTO 1000
935   PRINT "YOU ARE OFFERED AN OPPORTUNITY TO INVEST $5,000 AT "
936   PRINT "18.5% INTEREST BUT YOUR MONEY IS TIED UP FOR 6 MONTHS": GOTO 1000
940   PRINT "YOU DECIDE TO CHANGE JOBS - LOSING 15% OF YOUR ANNUAL SALARY": GOTO 1000
945   PRINT "YOUR NEW HOBBY NOW COST $100/MONTH OF YOUR SAVINGS": GOTO 1000
950   PRINT "YOUR HOUSE IS ROBBED - LOSSES TOTAL $15,000": GOTO 1000
955   PRINT "YOU HAVE $2,500 IN LEGAL EXPENSES DUE TO A LAWSUIT": GOTO 1000
960   PRINT "YOUR RESIDENCE BURNS DOWN - LOSS OF $40,000 IN PERSONNEL"
965 PRINT "YOU GET PROMOTED BUT MUST MOVE TO ANOTHER STATE": GOTO 1000
970 PRINT "YOU MUST SERVE ON A JURY FOR A MURDER TRIAL - JURY SEQUESTERED FOR
    TWO WEEKS":   GOTO 1000
975 PRINT "YOU HAVE A TRAFFIC ACCIDENT, FOUND GUILTY OF MANSLAUGHTER AND"
976 PRINT "MUST PAY A FINE OF $10,000 AND GO TO JAIL FOR 6 MONTHS": GOTO 1000
980 PRINT "YOUR MOTHER DIES AND YOU MUST MAKE FUNERAL ARRANGEMENTS IN ANOTHER
    STATE IMMEDIATELY' GOTO 1000
985 PRINT "YOU SET UP A TAX SHELTERED ANNUITY FOR $250/MONTH": GOTO 1000
990 PRINT "YOU CHARTER A TRIP TO EUROPE AND THE COMPANY HANDLING IT"
991 PRINT "GOES BANKRUPT WHILE YOU ARE STILL IN EUROPE"
1000 LET A3=A2: IF Z=1 THEN  LET A4=A2
1005 NEXT Z1
1006 CURSOR 14,1: IN PUT "PRESS ' R ET U RN '  T O  G O  ON",Z$
1007 GOTO 1020
1010 PRINT "&K": PRINT : PRINT : PRINT : PRINT : RETURN
1020 GOSUB 1010: RESTORE 3200: IF G$="1" THEN  RESTORE 3440
1030 PRINT "FATE HAS DEEMED THE FOLLOWING FAMILY CIRCUMSTANCES"
1035 PRINT "FOR YOU:": PRINT : LET Q3=0
1040 LET Y5=INT(RND(0)*5+.5): IF Y5<2 OR Y5>3 THEN 1040
1070 LET Y4=INT(RND(0)*5+5): LET Y3=INT(RND(0)*11)
1075 LET P1=35: IF G$="2" THEN  LET P1=21
1080 FOR X=1 TO P1
1085   READ J$
1090   IF X<=Y3 THEN 1150
1095   LET Y3=Y3+Y4: IF Y3>P1 THEN  EXIT 1170
1100   FOR X9=1 TO 4
1110     IF J$(X9,X9)<>F$ THEN 1140
1115     IF J$=K$ THEN 1140
1116     IF J$=H$ THEN 1140
1120     PRINT J$(5,40): LET Q3=Q3+1: LET K$=J$: IF Q3=1 THEN  LET H$=J$
1130     IF Q3>=Y5 THEN  EXIT 1180
1140   NEXT X9
1145   IF G$="1" THEN  RESTORE 3200
1150 NEXT X
1170 LET Y4=1: LET Y3=1: RESTORE 3200: GOTO 1080
1180 CURSOR 14,1: PRINT "THANK YOU FOR YOUR TIME -- NEXT!!"
1190 PAUSE 100: INPUT "PRESS 'RETURN' FOR THE NEXT STUDENT",R$
1200 GOTO 100
```

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```
2000 DATA "XXXXEACCOUNTANT     10.7-26.0OFFICE    "
2010 DATA "XXXXEADVERTISING     9.0-30.0OFFICE    "
2020 DATA "XXCDEAIRPLANE MECH  13.0-20.0TRANSP    "
2030 DATA "XXCDEAIR TRAFFIC CR 11.0-26.0TRANSP    "
2040 DATA "ABCXXAPPLIANCE REP  13.0-17.0MECH/RPAIR"
2050 DATA "XXXXEARCHITECT      13.0-27.0DESIGN    "
2060 DATA "ABCXXASSEMBLER       7.0-13.0INDUSTRIAL"
2070 DATA "ABCDXAUTO BODY REP  13.0-19.5MECH/RPAIR"
2080 DATA "ABCDXAUTO MECH      13.0-19.5MECH/RPAIR"
2090 DATA "ABCXXAUTO PARTS WORK 9.5-16.0SALES     "
2100 DATA "ABCXXAUTO SALES WORK11.0-19.5SALES     "
2110 DATA "ABCXXBANK CLK/TELLER 8.0-11.0OFFICE    "
2120 DATA "XXXXEBANK OFFICER   11.0-30.0OFFICE    "
2130 DATA "XXCDXBARBER          9.0-17.5SERVICE   "
2140 DATA "AXCDXBOOKEEPER      10.0-15.5OFFICE    "
2150 DATA "XXCDXBROADCAST TECH 13.0-26.0SCI/TECH  "
2160 DATA "ABCXXBUILD CUSTODIAN 8.0-13.0SERVICE   "
2170 DATA "ABCXXBUS MACH REPAIR 9.5-22.0MECH/RPR  "
2180 DATA "XXCDXCARPENTER      13.0-22.0CONST.    "
2190 DATA "ABCXXCASHIER         7.0-11.0OFFICE    "
2200 DATA "XXXXECLERGY          UNKNOWN SOC. SER. "
2210 DATA "XXXXECOLL/UNIV TEACH15.0-27.0EDUCATION "
2220 DATA "XXXDECOMMER. ARTIST  8.0-27.0ART/DESIGN"
2230 DATA "XXCDXCOMPUTER OPER.  9.0-22.0OFFICE    "
2240 DATA "XXXXEELEM TEACHER.   9.0-20.0EDUCATION "
2250 DATA "XXXXEENGINEER       13.0-30.0SCI./TECH."
2260 DATA "XXCDXENGINEING TECH  9.0-17.5SCI./TECH."
2270 DATA "XXXXEENVIRONMENT SCI13.0-26.0SCI./TECH."
2280 DATA "ABCXXFARM WORKER    11.0-22.0SCI./TECH."
2290 DATA "ABCXXFIREFIGHTER    10.0-19.0SERVICE   "
2300 DATA "XXXDXFLIGHT ATTEND.  9.4-15.5TRANSPORT."
2310 DATA "XXCXEFORESTER       11.4-24.0SCI/TECH. "
2320 DATA "XXCDXFORESTRY TECH   8.0-13.0SCI/TECH. "
2330 DATA "XXCDXELECTRICIAN    13.5-24.0CONSTRUCT."
2340 DATA "XXXXEHEALTH INSP    10.0-25.0SERVICE   "
2350 DATA "XXXXEHEALTH SER ADMS14.0-44.0HEALTH    "
2360 DATA "ABCDEHEATING/AIR MEC11.0-22.0MECH/REPR."
2370 DATA "XXXXEHOME ECONOMIST  9.5-21.0SOC SER   "
2380 DATA "ABCXXHOTEL CLERK     7.0-10.0OFFICE    "
2390 DATA "XXXXEHOTEL MANAGER  10.0-27.0OFFICE    "
2400 DATA "ABCDEIND MACH REPAIR13.0-17.5MECH/RPR  "
2410 DATA "ABCDEINSTRUMENT RPR 12.0-16.5MECH/RPR  "
2420 DATA "ABXXEINSURANCE AGENT11.0-30.0OFFICE    "
2430 DATA "XXXDEINTERIOR DESIG  8.0-30.0ART/DESIGN"
2440 DATA "XXCDXIRONWORKER     11.0-21.0CONSTRUCT "
2450 DATA "XXXXELAWYER         13.0-40.0OFFICE    "
2460 DATA "XXXXELIBRIAN        10.5-24.0EDUCATION "
2470 DATA "XXXDXLIBRY TECH      9.0-14.0EDUCATION "
2480 DATA "XXXXELIFE SCIENTIST 12.0-28.0SCI/TECH  "
2490 DATA "XXXDXLITHOGRAPHIC   11.0-22.0INDUSTRIAL"
2500 DATA "ABCXXLUMBER WORKER   9.0-17.5INDUSTRIAL"
2510 DATA "ABCDXMACHINIST      11.0-18.5INDUSTRIAL"
2520 DATA "ABCXXMAIL CARRIER   11.0-14.5SERVICE   "
2530 DATA "XXXDXMANUF SALESWRKR10.5-35.0SALES     "
2540 DATA "XXXXEMARKETING RES  14.0-30.0OFFICE    "
2550 DATA "XXXXEMATHEMATICIAN  13.0-30.0SCIENTIFIC"
2560 DATA "ABCDXMEATCUTTER     11.0-17.0SERVICE   "
2570 DATA "XXCDXMEDICAL ASSIST  8.0-11.5HEALTH    "
2580 DATA "XXXXEMEDICAL WORKER  9.0-16.5HEALTH    "
2590 DATA "XXXXENEWSPAPER RPTR 10.0-27.0COMMUNIC  "
2600 DATA "XXCDXNURSE LICENSED  9.5-13.5HEALTH    "
2610 DATA "XXCXENURSE RN       11.0-17.0HEALTH    "
2620 DATA "XXCDXNURSING AIDE    7.0- 8.5HEALTH    "
2630 DATA "XXXXEOCCUP THERAPIST11.0-22.0HEALTH    "
2640 DATA "XXCDXOFFICE MACH OPP 8.0-11.0OFFICE    "
2650 DATA "XXCDXOPERATION ENGIN11.0-22.0CONST.    "
2660 DATA "XXXXEOPTOMERIST     16.0-35.0HEALTH    "
2670 DATA "XXCDXPAINTER        11.0-19.5CONST.    "
2680 DATA "XXXDEPERFORMING ART 10.5-27.5ART       "
2690 DATA "XXXXEPERSONNEL      11.0-27.0OFFICE    "
2700 DATA "XXXXEPHARMACIST     10.5-14.5HEALTH    "
2710 DATA "XXCDXPHOTOGRAPHER    9.5-19.5ART/DESIGN"
2720 DATA "XXXXEPHYSICAL SCI   13.0-30.0SCI/TECH  "
2730 DATA "XXXXEPHYSICAL THERAP11.0-22.0HEALTH    "
2740 DATA "XXXXEPHYSICAN       25.0-55.0HEALTH    "
2750 DATA "XXCDEPILOT (AIR)    15.0-55.0TRANSP.   "
2760 DATA "XXCDXPLUMBER        15.0-22.0CONST.    "
2770 DATA "XXCDXPOLICE OFFICER 11.0-20.0SOC SER   "
2780 DATA "ABCXXPOSTAL CLERK   10.7-12.0OFFICE    "
2790 DATA "XXXXEPROBATION OFFIC11.0-20.0SCO SERV  "
2800 DATA "XXXDEPROGRAMMER     11.0-27.0OFFICE    "
2810 DATA "XXXXEPSYCHOLOGIST   13.0-27.0SOC SERV  "
2820 DATA "XXXDEPUBLIC RELAT   11.0-33.0OFFICE    "
2830 DATA "XXXXEPURCHASING     11.0-27.5OFFICE    "
2840 DATA "XXXDXRADIOLOGIST     9.5-14.0HEALTH    "
2850 DATA "XXXDXREAL ESTATE    WIDE RANGSALES     "
2860 DATA "ABCXXRECEPTIONIST    6.5- 8.5OFFICE    "
2870 DATA "XXCDXRECREATION      9.5-24.0SOC SERV  "
2880 DATA "XXCDXRESP THERAPY    9.0-17.0HEALTH    "
2890 DATA "ABXXXRETAIL SALES    6.2-15.5SALES     "
2900 DATA "XXXXESEC TEACHER    10.5-21.0EDUCATION "
2910 DATA "XXXDXSECRETARY       7.0-13.0OFFICE    "
2920 DATA "XXXDESECURITIES WKR 11.0-30.0SALES     "
2930 DATA "ABCXXSERVICE STATION 6.0-11.0SALES     "
2940 DATA "ABCXXSPIPPING CLERK  8.0-11.0OFFICE    "
2950 DATA "XXXXESOCIAL SCIENT. 13.0-30.0SOC SCI   "
2960 DATA "XXXXESOCIAL WORKER  10.0-20.0SOC SCI   "
2970 DATA "XXXXESPEECH PATHOL  11.0-30.0HEALTH    "
2980 DATA "XXCDXSURVEYOR        9.0-17.0SCI/TECH  "
2990 DATA "XXXXESYSTEMS ANALY  14.0-30.0OFFICE    "
3000 DATA "XXXXETEC. WRITER    10.0-24.0COMMUNIC. "
3010 DATA "ABCXXTELEPHONE WORK  8.5-17.0MECH/RPR. "
3020 DATA "ABCXXTELEPHONE OPER  8.5-12.0SERVICE   "
3030 DATA "ABCXXBUS/TRUCK DRIVE11.0-22.0TRANSPORT."
3040 DATA "XXCDXTV REPAIR       8.5-19.0MECH/PRR. "
3050 DATA "ABCXXTYPIST          7.0-10.0OFFICE    "
3060 DATA "XXXXEURBAN PLANNER  14.0-33.0OFFICE    "
3070 DATA "XXXXEVETERINARIAN   17.5-40.0HEALTH    "
3080 DATA "ABCXXWAITER          6.0-14.0SERVICE   "
3090 DATA "XXCDXWELDER         10.5-22.0INDUSTRIAL"
3100 DATA "XXXDXWHOLESALES     10.5-20.0SALES     "
3110 DATA "XXXXXX"
3200 DATA "X234MATE DIES                            "
3210 DATA "X234WIFE OR WOMAN HAS TWINS             "
3220 DATA "XX34MATE HAS EXTRA MARIRAL AFFAIR       "
3230 DATA "X234MATE BECOMES AN ALCHOLIC            "
3240 DATA "XX34SEVERE COMMUNICATION PROBLEMS       "
3250 DATA "1234BREADWINNER BECOMES DISABLED        "
3260 DATA "XX34SERIOUS INLAW PROBLEMS              "
3270 DATA "X234WIFE OR WOMAN BECOMES PREGNANT      "
3280 DATA "1234BREADWINNER BECOMES PARTIALLY BLIND "
3290 DATA "XX34MARRIAGE CONSIDERED HAPPY BY PEERS  "
3310 DATA "X234COUPLE DECIDES TO ADOPT CHILDREN    "
3320 DATA "X234COUPLE HAS RELIGIOUS EXPERIENCE     "
3330 DATA "X234COUPLE SEPARATED 3 MO. DUE TO JOB   "
3340 DATA "1234MAN IS DRAFTED                      "
3350 DATA "1234WOMAN IS DRAFTED                    "
3360 DATA "X234FINANCIAL PROBLEMS                   "
3370 DATA "1234BREADWINNER RETIRES INCOME 50% DOWN "
3380 DATA "1234RECOGNITION FOR CHARITABLE WORK     "
3390 DATA "1234PARENT(S) MOVE IN WITH YOU          "
3400 DATA "1234JOIN A SERVICE ORGNIZATION (1/MO.)  "
3410 DATA "1234ELECTED MAYOR OF YOUR TOWN          "
3420 DATA "1234SISTER DIVORCED STAYS WITH YOU      "
3430 DATA "XX34YOU GET A DIVORCE                   "
3435 DATA "X234TEENAGED DAUGHTER RUNS AWAY         "
3440 DATA "X234ONE CHILD ILL - MEDICAL BILLS       "
3450 DATA "1234WOMAN UNABLE TO BECOME PREGNANT     "
3460 DATA "1234MAN IS UNABLE TO FATHER CHILDREN    "
3470 DATA "1234OLDEST CHILD DIES IN CAR WRECK      "
3480 DATA "1234YOU HAVE A HANDICAPPED CHILD        "
3490 DATA "1234YOUR 16 YEAR OLD FATHERS A CHILD    "
3500 DATA "XX34DIVORCED-SPOUSE CUSTODY OF CHILD    "
3510 DATA "XX34DIVORCED-YOU GET CUSTODY OF CHILD   "
3520 DATA "1234CHILD GETS FULL SCHOLARSHIP TO USC  "
3530 DATA "1234CHILD GETS SCHOLARSHIP TO HARVARD   "
3540 DATA "1234CHILD CANNOT GET SCHOLARSHIP        "
```

```
PLEASE ENTER YOUR CHOICE OF EDUCATIONAL PREFERENCE:
         A - QUIT HIGH SCHOOL AT 16 AND ENTER THE JOB MARKET
         B - GRADUATE FROM HIGH SCHOOL AND ENTER JOB MARKET
         C - JOIN THE MILITARY AFTER HIGH SCHOOL
         D - GO TO A TRADE, TECHNICAL, OR JUNIOR COLLEGE
         E - GO TO AND COMPLETE A 4-YEAR COLLEGE PROGRAM
         F - COMPLETE GRADUATE STUDIES

YOUR CHOICE PLEASE THEN PRESS 'RETURN'  F



PLEASE ENTER YOUR CHOICE OF FAMILY SITUTATION:

         YOU WILL:
              1 - NOT MARRY
              2 - LIVE TOGETHER WITH SOMEONE
              3 - MARRY BEFORE COMPLETING JOB PREPARATION
              4 - MARRY AFTER COMPLETING JOP PREPARATION
YOUR CHOICE FOR -A- (1 THRU 4) THEN PRESS 'RETURN' 4
```

```
               WILL YOU
                    1 - HAVE CHILDREN
                    2 - NOT HAVE CHILDREN

  YOUR CHOICE FOR -B- (1 OR 2) THEN PRESS 'RETURN'1

  OCCUPATIONAL CHOICES BASED ON EDUCATIONAL PREPARATION
   1       ACCOUNTANT        9.7-24.0  OFFICE
   2       ADVERTISING       8.0-28.0  OFFICE
   3       AIRPLANE MECH    12.0-18.0  TRANSP
   4       AIR TRAFFIC CR   10.0-24.0  TRANSP
   5       ARCHITECT        12.0-25.0  DESIGN
   6       BANK OFFICER      9.0-26.0  OFFICE
   7       CLERGY           UNKNOWN    SOC. SER.
   8       COLL/UNIV TEACH  14.0-25.0  EDUCATION
   9       COMMER. ARTIST    7.0-25.0  ART/DESIGN
   10      ELEM TEACHER.     8.0-18.0  EDUCATION
  PLESE ENTER YOUR OCCUPATIONAL CHOICE AND
  PRESS 'RETURN' OR PRESS 'RETURN' FOR THE NEXT PAGE

   11      ENGINEER         12.0-27.0  SCI./TECH.
   12      ENVIRONMENT SCI  12.0-24.0  SCI./TECH.
   13      FORESTER         10.4-22.0  SCI/TECH.
   14      HEALTH INSP       9.0-23.0  SERVICE
   15      HEALTH SER ADMS  12.0-40.0  HEALTH
   16      HEATING/AIR MEC  10.0-20.0  MECH/REPR.
   17      HOME ECONOMIST    8.5-19.0  SOC SER
   18      HOTEL MANAGER     9.0-25.0  OFFICE
   19      IND MACH REPAIR  12.0-16.0  MECH/RPR
   20      INSTRUMENT RPR   11.0-15.0  MECH/RPR
  PLESE ENTER YOUR OCCUPATIONAL CHOICE AND
  PRESS 'RETURN' OR PRESS 'RETURN' FOR THE NEXT PAGE

   21      INSURANCE AGENT  10.0-28.0  OFFICE
   22      INTERIOR DESIG    7.0-28.0  ART/DESIGN
   23      LAWYER           12.0-37.0  OFFICE
   24      LIBRIAN           9.5-22.0  EDUCATION
   25      LIFE SCIENTIST   11.0-25.0  SCI/TECH
   26      MARKETING RES    13.0-28.0  OFFICE
   27      MATHEMATICIAN    11.0-27.0  SCIENTIFIC
   28      MEDICAL WORKER    8.0-15.0  HEALTH
   29      NEWSPAPER RPTR    9.0-25.0  COMMUNIC
   30      NURSE RN         10.0-15.0  HEALTH
  PLESE ENTER YOUR OCCUPATIONAL CHOICE AND
  PRESS 'RETURN' OR PRESS 'RETURN' FOR THE NEXT PAGE

   31      OCCUP THERAPIST  10.0-20.0  HEALTH
   32      OPTOMERIST       15.0-32.0  HEALTH
   33      PERFORMING ART    9.5-25.0  ART
   34      PERSONNEL        10.0-25.0  OFFICE
   35      PHARMACIST        9.5-13.0  HEALTH
   36      PHYSICAL SCI     12.0-28.0  SCI/TECH
   37      PHYSICAL THERAP  10.0-20.0  HEALTH
   38      PHYSICAN         22.0-50.0  HEALTH
   39      PILOT (AIR)      13.0-50.0  TRANSP.
   40      PROBATION OFFIC  10.0-18.0  SCO SERV
  PLESE ENTER YOUR OCCUPATIONAL CHOICE AND
  PRESS 'RETURN' OR PRESS 'RETURN' FOR THE NEXT PAGE36


  YOUR CHOICE WAS:

     DESCRIPTION        PAY(X1000)   JOB CLUSTER
     PHYSICAL SCI       12.0-28.0     SCI/TECH
  PRESS 'RETURN' TO CONTINUE


FATE HAS GIVEN YOU THE FOLLOWING FINANCIAL CIRCUMSTANCES
TO DEAL WITH:

YOUR RESIDENCE BURNS DOWN - LOSS OF $40,000 IN PERSONAL
POSSESSIONS
YOU ARE OFFERED AN OPPORTUNITY TO INVEST $5,000 AT
18.5% INTEREST BUT YOUR MONEY IS TIED UP FOR 6 MONTHS
PRESS 'RETURN' TO GO ON


FATE HAS DEEMED THE FOLLOWING FAMILY CIRCUMSTANCES
FOR YOU:
JOIN A SERVICE ORGNIZATION (1/MO.)
WIFE OR WOMAN HAS TWINS
MATE HAS EXTRA MARITAL AFFAIR
THANK YOU FOR YOUR TIME -- NEXT!!
```

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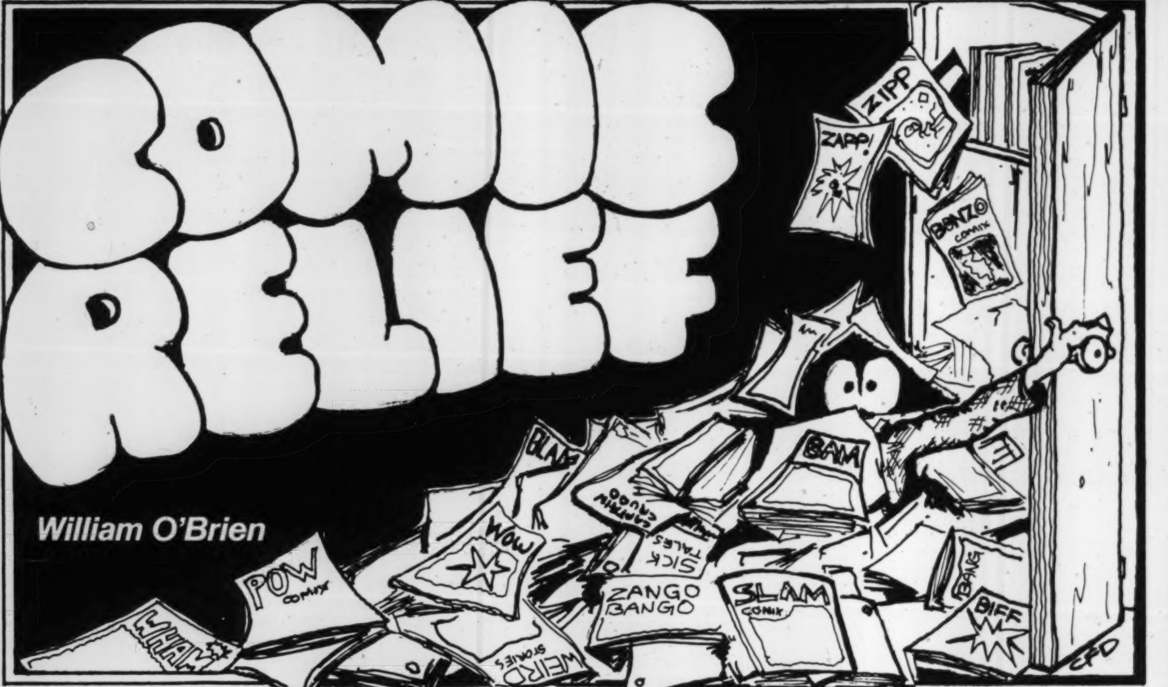

COMIC RELIEF

William O'Brien

Certain questions recur throughout our lives. Among the more repetitive are the all-too-famous "Why does a chicken cross the road," "Why do firemen wear red suspenders," and "What do you do when you're pelted about the head and shoulders by a torrential downpour of comic books when you open the closet door."

We've all heard them a thousand times with the same cliche answers whipped off by rote. But this time will be differen[illegible]ot owning chickens or red suspenders, I will leave these topics to more mundane writers. I have chosen to tackle the hardest of them all!

It comes as a terrible shock when a person finally admits that he or she is an avid—no, addicted—comic fiend. It was hard for me to come to that point in my life. In fact, it took a near tragedy. I can remember that day well.

I dragged my weary body up the stairs of the "A" train, a wicked device used here in New York to test the durability of a subway rider. On the pretext of buying some cigarettes I entered my local "candy" store. I knew what was there before I went in, but I am the consummate actor!

Glancing about, I walked in as though I intended to head straight to the counter, but it was difficult to keep my eyes from straying. As though interested solely in the commotion, I forced my gaze to a collection of mewling, snuffling youngsters, knowing well what they crowded over. Deep in my heart I begrudged their presence, bemoaning that at any moment one of those grubby little hands might snatch up a first issue or the last copy of a comic I wanted. I forced a casual "Oh," and with a polite "Excuse me, please" I placed myself between them and the precious contents of the racks.

Now I gloated as I snatched up title after title without regard to price or number. I knew without looking that their little eyes went wide with astonishment and perhaps more than a little envy. Deep in my heart I knew I should be ashamed. I hated what I had become: a comic junkie. I raised myself from my crouch and left the motley crew murmuring "Wows," while parents sneered at me and pulled the children away.

> ***The folly of my ways was all too clear to me now! There, slouched in the hall, covered with comics, I vowed to change my life.***

I paid for my purchase and quickly fled to the secure confines of my apartment where I pored over the colored pages, drinking in the text. Not even the advertisements escaped my notice. Then, with my lusts stated, I took my precious posessions to my *sanctum sanctorum* for storage. Little did I know where opening my hall closet at that moment would lead.

Whether it was pure coincidence or some hand of a higher source giving direction to the warped pattern my life had assumed, I do not know to this day. But when I opened that door my life changed.

It was like a scene from every old comedy. Comics poured from the overtaxed shelves in what seemed a never ending stream, striking me, covering me with their pulp pages. And then, when I thought the worst was over, one last comic fell. It was *Battlestar Galactica* #4. I'll always remember it. Smack on the top of my head it landed. Unconscious it was worse. Visions of little children, grotesque with vengence, swarmed about me, clutching small change that fell just short of the amount needed to buy a comic book. When I awoke it was if I had been reborn!

The folly of my ways was all too clear to me now! There, slouched in the hall, covered with comics, I vowed to change my life.

I pulled my old Apple II packing carton out of the bedroom closet, narrowly avoiding another avalanche, and began to pack the piled pulpers. But I had not purged myself completely! The sight of old *Doctor Strange* covers, issue #1 of *Swamp Thing*, the beauteous Spiderwoman all evoked a twinge deep in my black heart. I couldn't just push them aside, condemn them to a dark life sealed in a carton—I just couldn't. Besides

---

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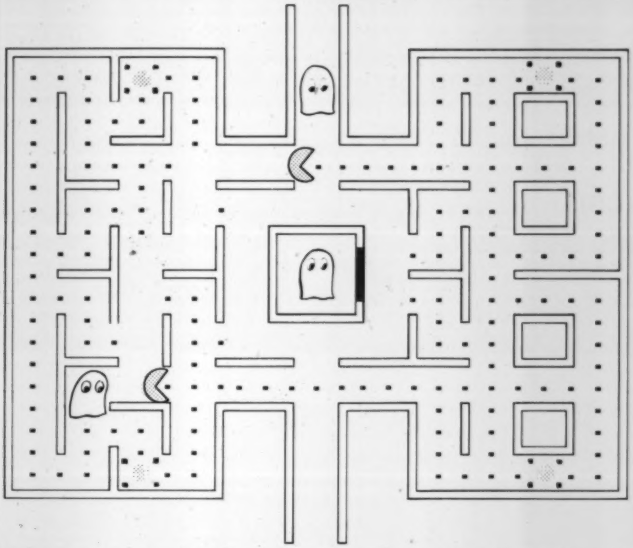

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Some of the problems are not new like the one asking how much the $24 the Indians were paid for Manhattan would be worth today had it been deposited in a bank. However, this problem was revised to have a variable interest rate so it would be a challenge to program. Of course, many of the problems are new and have never been in print before.

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Comic Relief, continued...

which, some of them were eight years old or older, and they were worth several times the cover value. There was a prospect I could relate to without self-degradation: profit! Why that's as American as pizza!

My two selves, the gluttonous, comic mongering snatcher of children's fantasies and the zealous, patriotic, apple pie eating, flag waving son of the pioneer had, at last, found common ground. No longer would I weasel my way to the front of the racks to buy up those colored tomes merely to gaze at the disappointment on those small faces—now I would do it because someday those comics would be worth money.

This left me with another dilemma, however. To trade, buy or sell anything you must know what it is you have or don't have. Stuffed in my Apple computer box, how would I know what was there? My memory was good, but not *that* good!

I spent a few hours playing Super Invader while I mulled over the problem; moved on to Wilderness Campaign; all the while visions of pages upon pages of loose leaf text or mountains of index cards danced in my head. Was there no solution? I drummed my fingers on the Apple case, trying to catalogue my choices, trying to sort through my problem, trying to lay out the basics I would need to bring this idea off.

Apple case? Logic, catalogue? Sort, basic? By the gods of CMOS, that was the answer! All the while it had been right in front of me staring my fingers in the face.

My mind raced wildly. What did I need? Entry procedure, sorting, search, cataloging, and of course hardcopy output.

I was a madman then! Pen in hand I sat and scribbled page after page of program lines, entering them into my Apple as each section was completed. I sequestered myself for days. My employer phoned, I said I was busy, I'd see him later. My girlfriend called, I told her I was Shell sorting, I'd get back to her. Only my dog, whimpering her necessities, managed to drag me away.

At last I emerged from my cloister, printouts in hand, more than a thousand titles tucked in the magnetic folds of my disk, the sweet taste of success watering my mouth. I shared the glory that touched Newton, Galileo, Frankenstein. COMICFILES was born!

And just as gloriously, it died.

Now there would be no point in bringing you this far, raising your hopes so high, just to dash them to pieces. In my search for the ultimate solution to my dilemma, such was my fervor that I neglected to remember that 34+12 is greater than 48-6. In essence, 12K of program plus 34K of data to be held in memory cannot fit in a 48K machine with Apple's DOS.

With a young lady waiting patiently in a car, I ran through my listing in a frenzy. I would let nothing stop me now! I was too close to admit defeat!

With a few deft keystrokes I wiped out the bulk of the programming, isolating the sort routine. Then, my fingers moving with the swiftness of a dueling rapier, I reassigned the procedure to sort from and to disk, thereby pushing a measly 800 entry possibility into the 2500 comic mark.

Granted, it is not laden with finesse, but then the monster was a hodgepodge of limb and ganglia, and, except for the bumbling of a lackey, its potential would have been unlimited.

What say? You don't save comics? I couldn't begin to tell you the pleasures you are denying yourself, the glee when all those little tiny mouths drop open, those little eyes so full of sorrow—but no, there's more to it than that. A 35 cent comic book worth $8.00; even with inflation, that is something to behold! But what about the magazine you're holding in your hand? Have a few more of those around? Maybe a few others? Some modifications to record volume and issue number rather than month and year and we have a concise method of knowing just what it is we have without having them collapse on us each time we open a door!

The program itself is a snap, and easily modifiable once you know what's going on.

Lines 99-490 set up the menu and await the user selected choice.

Lines 500-770 respond to an Initial or Additional entry selection, storing the data in a Random Access file whose length is 34.

Lines 800-860 update the LOF file which keeps track of how many entries were made.

Lines 870-1300 handle printouts of the full file. The user is prompted for screen or printer output. A video display of the entries is stoppable at the completion of each full screen. The hardcopy is formated for a standard 11 inch long page and will skip perforations.

Lines 1310-2100 are shared by both the Single Entry Recall and Editing program functions since editing any of the entries requires finding it first.

Lines 2110-2870 manage the Range Print routine, allowing either video or hardcopy output.

The sort routine is self-evident. Again, nothing fancy, and definitely nothing you would want to sit down and wait for once you get into the 1000+ entry range, but it gets the job done.

That, then, was my deliverance. No longer do I bludgeon little hands that grope for treasures they can hardly hope to appreciate. Now I simply smile, knowing the useless piles those few that escape me will become, further driving up the price of the ones I file, catalogue and protect. □

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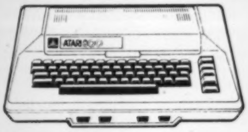

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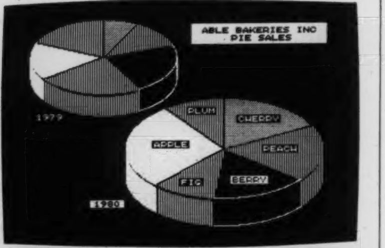

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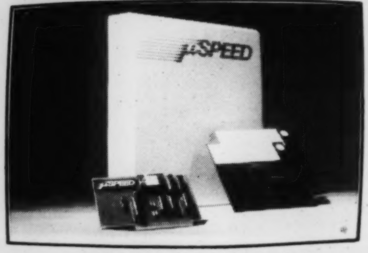

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CIRCLE 121 ON READER SERVICE CARD

Comic Relief, continued...

```
900  HOME : VTAB 20: HTAB 1: PRINT "INSERT DATA DISK...": PRINT "PRESS ´R
     ETURN WHEN READY.": GET A$: IF A$ <  >  CHR$ (13) THEN 900
950  HOME
960 D$ =  CHR$ (13) + ""
970  PRINT D$;"OPEN LOF"
980  PRINT D$;"READ LOF"
990  INPUT N
1010  PRINT D$;"CLOSE LOF"
1020  PRINT D$;"OPEN TEMPFILE, L34"
1100 I = 0
1110 GP = N
1120  IF GP <  = 1 THEN 1290
1130 GP =  INT (GP / 2)
1140 MI = N - GP
1150 FL = 0
1160  PRINT ""
1170  FOR I = 1 TO MI
1180 GI = GP + I
1181  PRINT D$;"READ TEMPFILE, R";I
1182  INPUT F1$
1183  PRINT D$;"READ TEMPFILE, R";GI
1184  INPUT F2$
1190  IF  LEFT$ (F1$,15) =  LEFT$ (F2$,15) THEN 1270
1200  IF  LEFT$ (F1$,15) <  LEFT$ (F2$,15) THEN 1240
1210 FL = 1
1220 :
1230 DM$ = F2$:F2$ = F1$:F1$ = DM$
1231  PRINT D$;"WRITE TEMPFILE, R";I
1232  PRINT F1$
1233  PRINT D$;"WRITE TEMPFILE, R";GI
1234  PRINT F2$
1240  NEXT I
1250  IF FL = 1 THEN 1150
1260  GOTO 1120
1270  IF  VAL ( RIGHT$ (F2$,3)) <  VAL ( RIGHT$ (F1$,3)) THEN 1230
1280  GOTO 1240
1290  PRINT D$;"CLOSE TEMPFILE"
1291  HOME : VTAB 20: HTAB 1: PRINT "INSERT PROGRAM DISK": PRINT "PRESS E
     NTER WHEN READY";
1292  GET A$: IF A$ <  >  CHR$ (13) THEN 1292
1300  PRINT D$;"RUN HELLO"
```

COMICFILES LISTING-Throughout, D$ is either a combination of a carriage return [CHR$(13)] and Control D [CHR$(4) which is most often shown as simply ""] or simply Control D [again, most often ""].

```
99  ONERR  GOTO 2880
100  HOME :D$ =  CHR$ (13) +  CHR$ (4)
110  VTAB 20: HTAB 1: PRINT "INSERT DATA DISK": PRINT "PRESS ´ENTER´ WHEN
      READY";
120  GET A$: IF A$ <  >  CHR$ (13) THEN 120
130  PRINT D$;"OPEN TEMPFILE, L34"
140  GOSUB 2780:N = FP
150  HOME
160 S$ = "                    "
170  VTAB 6
180  VTAB 6: PRINT "OPERATIONAL FUNCTIONS: "
190  VTAB 9: HTAB 4: PRINT "1.INITIAL ENTRY"
200  HTAB 4: PRINT "2.ADDITIONAL ENTRY"
210  HTAB 4: PRINT "3.PRINT OF ALL ENTRIES"
220  HTAB 4: PRINT "4.SORT ENTRIES"
230  HTAB 4: PRINT "5.AMEND ENTRY"
240  HTAB 4: PRINT "6.RANGE PRINT"
250  HTAB 4: PRINT "7.SINGLE ENTRY RECALL"
260  HTAB 4: PRINT "8.END SESSION"
270  VTAB 19: HTAB 1: PRINT "YOUR CHOICE...:";
280  GET C$
290 C =  VAL (C$)
```

```
300  IF  ASC (C$) > 56 OR  ASC (C$) < 49 THEN 280
310  HOME
320  IF C = 1 OR C = 2 THEN 500
330  IF C <  > 3 THEN 380
340  IF C = 3 THEN  HOME : VTAB 15: HTAB 1: PRINT "OUTPUT TO ";: INVERSE
     : PRINT "P";: NORMAL : PRINT "RINTER OR ";: INVERSE : PRINT "S";: NORMAL
     : PRINT "CREEN ?";
350  GET S1$
360  IF S1$ <  > "P" AND S1$ <  > "S" THEN 350
370  GOTO 870
380  IF C = 4 THEN  GOSUB 780: IF N > FP THEN  GOSUB 800: HOME
390  IF C = 4 THEN  VTAB 20: HTAB 1: PRINT "INSERT PROGRAM DISK...": PRINT
     "PRESS 'RETURN' WHEN READY.": GET A$: IF A$ <  >  CHR$ (13) THEN 390

400  IF C = 4 THEN  HOME : PRINT D$;"RUN SORT2"
410  IF C = 5 THEN 1470
420  IF C <  > 6 THEN 470
430  IF C = 6 THEN  HOME : VTAB 15: HTAB 1: PRINT "OUTPUT TO ";: INVERSE
     : PRINT "P";: NORMAL : PRINT "RINTER OR ";: INVERSE : PRINT "S";: NORMAL
     : PRINT "CREEN ?";
440  GET S1$
450  IF S1$ <  > "P" AND S1$ <  > "S" THEN 350
460  HOME : GOTO 2110
470  IF C = 7 THEN 1310
480  IF C = 8 THEN  GOSUB 780: IF N > FP THEN  GOSUB 800
490  HOME : END
500 N = N + 1
510  IF N = 2495 THEN  GOSUB 2840
520  IF N = 2496 THEN  GOSUB 2840
530  IF N = 2497 THEN  GOSUB 2840
540  IF N = 2498 THEN  GOSUB 2840
550  IF N = 2499 THEN  GOSUB 2840
560  IF N = 2500 THEN  GOSUB 2850
570  IF N > 2500 THEN  GOSUB 2830: HOME : GOTO 180
580  INPUT "TITLE: ";T$
590  IF T$ = "END" THEN N = N - 1: HOME : GOTO 180
600  IF  LEN (T$) >  = 15 THEN T$ =  LEFT$ (T$,15)
610  IF  LEN (T$) < 15 THEN T$ = T$ +  LEFT$ (S$,15 -  LEN (T$))
620  INPUT "PUBLISHER: ";P$
630  IF  LEN (P$) >  = 8 THEN P$ =  LEFT$ (P$,8)
640  IF  LEN (P$) < 8 THEN P$ = P$ +  LEFT$ (S$,8 -  LEN (P$))
650  INPUT "MONTH: ";M$:M2$ =  LEFT$ (M$,3)
660  INPUT "YEAR: ";Y$:Y2$ =  RIGHT$ (Y$,2)
670 DT$ = M2$ + "/" + Y2$
680 :
690  INPUT "ISSUE #: ";I$
700  IF  LEN (I$) > 3 THEN  VTAB 5: HTAB 1: PRINT S$;: VTAB 5: HTAB 1:
     GOTO 690
710  IF  LEN (I$) < 3 THEN I$ =  LEFT$ (S$,3 -  LEN (I$)) + I$
720 CM$ = T$ + P$ + DT$ + I$
730  PRINT D$;"WRITE TEMPFILE, R";N
740  PRINT CM$
750  PRINT  CHR$ (4)
760  HOME
770  GOTO 500
780  PRINT D$;"CLOSE TEMPFILE"
790  RETURN
800  PRINT D$;"OPEN LOF"
810  PRINT D$;"DELETE LOF"
820  PRINT D$;"OPEN LOF"
830  PRINT D$;"WRITE LOF"
840  PRINT N
850  PRINT D$;"CLOSE LOF"
860  RETURN
870  IF S1$ = "P" THEN D$ = "": GOTO 890
880 D$ =  CHR$ (13) + ""
890  HOME : IF S1$ <  > "P" THEN  GOSUB 1280: GOTO 980
900  PRINT  CHR$ (13); CHR$ (4);"PRN1"
910  PRINT D$
920  FOR X = 1 TO 2: PRINT  CHR$ (13): NEXT X: PRINT  SPC( 10);
930  PRINT  SPC( 3);"TITLE"; SPC( 15);"PUB."; SPC( 7);"DATE"; SPC( 8);"ISSUE"
```

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CIRCLE 254 ON READER SERVICE CARD

Comic Relief, continued...

```
940  PRINT  SPC( 13);"=====";  SPC( 15);"====";  SPC( 7);"====";  SPC( 8);
     "=====";: IF F1 =
 PRINT  CHR$ (13);: RETURN
950  PRINT  CHR$ (13)
960  PRINT D$;"PR#0"
970  PRINT D$
980 :
990  FOR I = 1 TO N
1000  PRINT D$;"READ TEMPFILE, R";I
1010  INPUT CM$
1020  PRINT D$
1030  IF S1$ = "P" THEN  PRINT D$;"PR#1"
1040  IF S1$ = "P" THEN  PRINT  SPC( 10)
1050 E$ =  STR$ (I): IF  LEN (E$) < 3 THEN E$ =  LEFT$ (S$,3 -  LEN ( STR$
     (I))) + E$
1060  IF S1$ = "P" THEN 1100
1070 TP = (I - ( INT (I / 20) * 20)) + 2
1080  IF  INT (I / 20) = I / 20 THEN TP = TP + 20
1090  VTAB TP: HTAB 1
1100 T$ =  LEFT$ (CM$,15) + " ":P$ =  MID$ (CM$,16,8) + " ":DT$ =  MID$ (
     CM$,24,6) + " ":I$ =  RIGHT$ (CM$,3)
1110  IF S1$ = "P" AND  VAL (I$) = 1 THEN I$ = I$ + "*"
1120  IF S1$ = "P" THEN 1140
1130  IF  VAL (I$) = 1 THEN  INVERSE
1140  PRINT E$ + ".";: IF S1$ = "P" THEN  PRINT T$; SPC( 3);P$; SPC( 1);D
     T$; SPC( 7);I$;: GOTO 1160
1150  PRINT T$;P$;DT$;I$;: GOTO 1200
1160  IF S1$ = "P" AND I / 55 =  INT (I / 55) THEN  FOR X = 1 TO 5: PRINT
      CHR$ (13);: NEXT X:F1 = 1: GOSUB 920:F1 = 0
1170  PRINT  CHR$ (13);: IF S1$ = "P" THEN  PRINT D$;"PR#0"
1180  IF S1$ = "P" THEN  PRINT D$
1190  IF S1$ = "P" THEN 1240
1200  NORMAL
1210  IF I / 20 =  INT (I / 20) THEN  VTAB 24: HTAB 1: PRINT "PRESS 'C' T
     O CONTINUE, 'E' TO END ";: GET RN$: IF RN$ <  > "C" AND RN$ <  > "E"
      THEN 1210
1220  IF I / 20 =  INT (I / 20) AND RN$ = "E" THEN  HOME : GOTO 180
1230  IF I / 20 =  INT (I / 20) AND RN$ = "C" THEN  GOSUB 1280
1240  NEXT I
1250  IF S1$ = "P" THEN D$ =  CHR$ (13) +  CHR$ (4): HOME : GOTO 180
1260  VTAB 24: HTAB 1: INPUT "PRESS RETURN TO CONTINUE";R$
1270  GOTO 180
1280  HOME : PRINT "    TITLE              PUB.     DATE  ISSUE";
1290  VTAB 3: HTAB 1
1300  RETURN
1310  HOME :RF = 1
1320  VTAB 15: HTAB 1: PRINT "SINGLE ENTRY RECALL: "
1330  VTAB 17: HTAB 6: PRINT "1.BY NAME & ISSUE #"
1340  HTAB 6: PRINT "2.BY FILE STORAGE #"
1350  HTAB 6: PRINT "3.FUNCTION COMPLETE"
1360  VTAB 21: HTAB 1: PRINT "YOUR CHOICE...";
1370  GET RT$: IF RT$ = "3" THEN  HOME :RF = 0: GOTO 180
1380  IF  VAL (RT$) > 3 OR  VAL (RT$) < 1 THEN 1370
1390  IF RT$ = "2" THEN 1550
1400  IF RT$ = "1" THEN 1920
1410  PRINT "TITLE              PUB      DATE   ISSUE";: PRINT  CHR$ (13):
      PRINT  T$;" ";P$;" ";DT$;"  ";I$
1420  VTAB 15: HTAB 1: PRINT "ANOTHER ?";
1430  GET RT$
1440  IF RT$ <  > "Y" AND RT$ <  > "N" THEN 1430
1450  IF RT$ = "Y" THEN 1310
1460  HOME :RF = 0: GOTO 180
1470  HOME : VTAB 15: PRINT "EDITING FETCH FUNCTIONS: "
1480 J = 0
1490  VTAB 17: HTAB 6: PRINT "1.BY NAME AND ISSUE#"
1500  VTAB 18: HTAB 6: PRINT "2.BY FILE STORAGE NUMBER"
1510  VTAB 19: HTAB 6: PRINT "3.EDITING COMPLETE"
1520  VTAB 21: HTAB 1: PRINT "YOUR SELECTION: ";: GET ET$: IF  VAL (ET$) >
     3 OR  VAL (ET$) < 1 THEN 1520
1530  IF ET$ = "3" THEN  HOME : GOTO 180
1540  IF ET$ = "1" THEN 1920
1550  HOME : VTAB 14: HTAB 1: INPUT "FILE NUMBER: ";CN
1560  IF CN > N THEN  HOME : VTAB 13: HTAB 1: PRINT "FILE NUMBER NOT CONT
     AINED IN THIS FILE": VTAB 23: HTAB 1: PRINT "PRESS ANY KEY TO CONTIN
     UE ";: GET RN$
```

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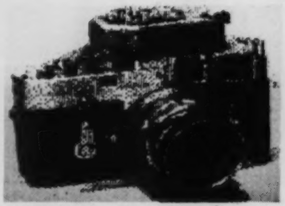

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CIRCLE 161 ON READER SERVICE CARD

Comic Relief, continued...

```
1570  IF CN > N AND RF = 1 THEN 1310
1580  IF CN > N THEN 1470
1590  HOME
1600  PRINT D$;"READ TEMPFILE, R";CN
1610  INPUT CM$
1620  PRINT  CHR$ (4)
1630 T$ =  LEFT$ (CM$,15)
1640 P$ =  MID$ (CM$,16,8)
1650 DT$ =  MID$ (CM$,24,6)
1660 I$ =  RIGHT$ (CM$,3)
1670  HOME : VTAB 1: HTAB 1
1680  IF RF = 1 THEN 1410
1690  PRINT T$: PRINT P$: PRINT DT$: PRINT I$
1700  IF RF = 1 THEN 1420
1710  VTAB 15: HTAB 1: PRINT "SELECTION BY: "
1720  VTAB 17: HTAB 1: PRINT "(T)ITLE, (P)UBLISHER, (D)ATE OR (I)SSUE #";
1730  PRINT " (A)LL COMPLETE";
1740  GET SC$
1750  IF SC$ = "T" THEN  VTAB 1: HTAB 1: PRINT S$: VTAB 1: HTAB 1: INPUT
     "";T$: IF  LEN (T$) > 15 THEN T$ =  LEFT$ (T$,15):J = 1
1760  IF SC$ = "T" AND  LEN (T$) < 15 THEN T$ = T$ +  LEFT$ (S$,15 -  LEN
     (T$)):J = 1
1770  IF SC$ = "P" THEN  VTAB 2: HTAB 1: PRINT S$;: VTAB 2: HTAB 1: INPUT
     "";P$: IF  LEN (P$) > 8 THEN P$ =  LEFT$ (P$,8):J = 1
1780  IF SC$ = "P" AND  LEN (P$) < 8 THEN P$ = P$ +  LEFT$ (S$,8 -  LEN (
     P$)):J = 1
1790  IF SC$ = "D" THEN  VTAB 3: HTAB 1: PRINT S$;: VTAB 20: HTAB 12: INPUT
     "MONTH: ";M$:M$ =  LEFT$ (M$,3):J = 1
1800  IF SC$ = "D" THEN  VTAB 20: HTAB 12: PRINT S$;: HTAB 12: INPUT "YEA
     R: ";Y$:Y$ =  RIGHT$ (Y$,2):DT$ = M$ + "/" + Y$:J = 1
1810  IF SC$ = "I" THEN  VTAB 4: HTAB 1: PRINT S$;: VTAB 4: HTAB 1: INPUT
     "";I$:J = 1
1820  IF  LEN (I$) < 3 THEN I$ =  LEFT$ (S$,3 -  LEN (I$)) + I$
1830  IF  LEN (I$) > 3 THEN  VTAB 23: PRINT "3 DIGITS ONLY": FOR CX = 1 TO
     200: NEXT CX: VTAB 4: HTAB 1: PRINT S$;: GOTO 1810
1840  IF SC$ = "A" AND J = 1 THEN 1870
1850  IF SC$ = "A" AND J = 0 THEN 1470
1860  HOME : GOTO 1670
1870 CM$ = T$ + P$ + DT$ + I$
1880  PRINT D$;"WRITE TEMPFILE, R";CN
1890  PRINT CM$
1900  PRINT  CHR$ (4)
1910  GOTO 1470
1920  HOME : VTAB 13: HTAB 12: INPUT "TITLE: ";N$
1930  IF  LEN (N$) > 15 THEN N$ =  LEFT$ (N$,15)
1940  IF  LEN (N$) < 15 THEN N$ = N$ +  LEFT$ (S$,15 -  LEN (N$))
1950  HOME : VTAB 13: HTAB 12: INPUT "ISSUE #: ";IN$
1960  IF  LEN (IN$) > 3 THEN  VTAB 20: PRINT "ISSUE NUMBER MUST BE A MAXI
     MUM OF 3 DIGITS"; VTAB 23: INPUT "PRESS RETURN TO CONTINUE: ";RN$: GOTO
     1950
1970  IF  LEN (IN$) < 3 THEN IN$ =  LEFT$ (S$,3 -  LEN (IN$)) + IN$
1980  HOME
1990  FOR CN = 1 TO N
2000  PRINT D$;"READ TEMPFILE, R";CN
2010  INPUT CM$
2020  IF N$ =  LEFT$ (CM$,15) AND IN$ =  RIGHT$ (CM$,3) THEN 2100
2030  IF N$ <  LEFT$ (CM$,15) THEN 2060
2040  NEXT CN
2050  PRINT D$
2060  HOME : VTAB 13: HTAB 1: PRINT "ENTRY NOT CONTAINED IN THIS FILE"
2070  FOR X = 1 TO 2000: NEXT X
2080  IF RF = 1 THEN 1310
2090  PRINT  CHR$ (4): GOTO 1470
2100  PRINT  CHR$ (4): GOTO 1630
2110  IF S1$ = "P" THEN D$ = ""
2120  VTAB 15: PRINT "CHOOSE SELECTION FIELD: "
2130  VTAB 17: HTAB 12: PRINT "1.TITLE"
2140  HTAB 12: PRINT "2.PUBLISHER"
2150  HTAB 12: PRINT "3.DATE"
2160  HTAB 12: PRINT "4.ISSUE NUMBER"
2170  VTAB 22: PRINT "YOUR CHOICE: ";
2180  GET SN$: IF  VAL (SN$) > 4 OR  VAL (SN$) < 1 THEN 2180
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Before you spend $200 — or $2000 — on a computer system that won't meet your needs, read this.

Straight Talk About Buying A Small Computer

A personal computer. If you don't already have one you're probably thinking about it.

The Plunge

Spending a couple of thousand or even a few hundred dollars is not something you do lightly. Making a decision about which computer to buy is not easy. Deciding about peripherals is even harder. And making intelligent decisions about software is nearly impossible.

But there's a way. *Creative Computing*. It's the magazine with the toughest evaluations in the industry.

In an industry prone to dazzling sales pitches filled with technical doubletalk, some straight advice from an unbiased source could make a lot of difference. Some of the newest computers on the market will be extinct before the first orders are filled; others will achieve astounding popularity. Which would you rather own?

Why Buy One?

The uses of a personal computer would fill several books. Some people have a specific use in mind, others just a general desire to join the computer age. In general, it's advisable to have a good idea of at least one or two things you want a computer to do for you. If you want to analyze stock options, for example, you'll want a computer for which a stock option package is available. If you want to work with color graphics your choice of computer is narrowed to those units with high resolution color output. Even after you've chosen some applications, the choice of a machine isn't easy. Here are a few things that might help.

Hard and Soft

Besides encountering hard and soft sells, you'll also encounter the terms "hardware" and "software." Hardware refers to the electronic parts of a computer system, the circuit boards, chips, peripherals, and other components.

An important part of hardware is memory. The amount of memory a computer has determines how much it can do. Most people start out with systems having 16K (K is short for kilobyte, which means 1024 bytes, or characters like a letter or number) of memory. Later, many people decide to expand their systems, and buy more memory.

Some of the new computers can be purchased with as little as 1K of memory. They can usually be expanded, but the upper limit varies. If you want to play games and write short programs, 16K is adequate. If you want to add a disk drive, or do word processing, you'll probably need 48K or more.

By themselves, these parts are rather dumb. The programs that instruct the computer how to do the more interesting applications (stock option analysis, animation, play a game) are usually contained on magnetic tape or disks. This is software.

Both hardware and software are important. A system with the wrong hardware can be as worthless to you as a sports car would be for a six-member family. Some computers cannot be connected to a printer. Others can't be expanded without a great deal of additional expense. You may not need these extras now, but if you anticipate needing them later, you'll want to select an appropriate system now. And a computer without good software is just an expensive dust catcher.

The Software Cycle

When a computer first hits the market, the only software available will be from the manufacturer. This limits the uses of the machine. As soon as a computer becomes popular, new software pours from dozens of sources. But there is a catch. People won't buy a computer until there is plenty of software available. And vendors won't produce the software until people start buying the computer. Where does this leave you? You can go with one of the established computers, or take a chance on a new machine.

The Newcomers

New computers are appearing almost monthly. One might be right for you. Can anyone tell for sure which will survive? Probably not. But the new machines can be compared against the old. If a computer does everything and more than another does, and costs less, it has a good chance of catching on. If it does less than existing computers, and costs about the same, it is probably doomed.

The Survivors

A few computers currently have the majority of the market. They all have good points and disadvantages. One costs less to start with, but costs more to expand. Another has great graphics but no lowercase letters—a bit of a problem if you want to do word processing. The limitations of any machine can be overcome, for a price. But it is better to get what you want at the start. If you know what you plan to use the computer for, the first step is to determine what that use requires. Do you want to play games? Then you have to decide how important joysticks, paddles, and other controls are. Some computers are supplied with these attachments. Some companies sell these attachments as extras. Do you want to use your own television? Or would you prefer a computer that comes with its own monitor? Will you demand complicated math capabilities from your computer? Certain computers can only handle integers.

Your Choice

Where does this leave you? If you've read this far, you are probably concerned about making the right choice. The following hints could be a good starting place. Take your time, and don't let your first impression of any computer prevent you from taking an honest look at its good and bad points. All computers seem impressive at first. Once you've looked at a few, you'll find that the initial awe is replaced by cold comparison. If you have a specific application in mind, ask to see the computer perform that application. If the salesman starts talking in technical terms while assuring you the machine will do what you want with only a few modifications, find another store. Ask about warranties. Will it be repaired at the store or sent out? Will they provide a loaner during repairs? Is the dealer authorized by the manufacturer?

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We have good reason to hope you buy a computer. Every new owner represents a potential reader for *Creative Computing*, the number one magazine of applications and software. We give the beginner a wealth of useful articles, tutorials, games, and ideas for his computer. And when the beginner becomes an expert, we still have a lot to offer; in-depth articles on programming, reviews of the latest products, highlights of important events in computer community and much more.

One beginner who became an expert, David Gerrold of *Star Trek* fame, had this to say, "*Creative Computing* with its unpretentious, down-to-earth lucidity encourages the computer user to have fun. *Creative Computing* makes it possible for me to learn basic programming skills and use the computer better than any other source."

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First Get the Facts

The first step to making intelligent buying decisions about computers, peripherals and software is arming yourself with the unbiased facts. You'll find these facts presented in a down-to-earth style in *Creative Computing*. Take the first step and subscribe today.

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CIRCLE 296 ON READER SERVICE CARD

Comic Relief, continued...

```
2190 SN =  VAL (SN$)
2200 :
2210  HOME : VTAB 13
2220  IF SN <  > 1 THEN 2280
2230  PRINT "TITLE RANGE: ";: FOR PF = 1 TO 15: PRINT ".";: NEXT PF: HTAB
     14
2240  INPUT "";N$
2250  IF  LEN (N$) >  = 15 THEN N$ =  LEFT$ (N$,15)
2260  IF  LEN (N$) < 15 THEN N$ = N$ +  LEFT$ (S$,15 -  LEN (N$))
2270  GOTO 2430
2280  IF SN <  > 2 THEN 2340
2290  PRINT "PUBLISHER RANGE: ";: FOR PF = 1 TO 10: PRINT ".";: NEXT PF: HTAB
     18
2300  INPUT "";N$
2310  IF  LEN (N$) >  = 8 THEN N$ =  LEFT$ (N$,8)
2320  IF  LEN (N$) < 8 THEN N$ = N$ +  LEFT$ (S$,8 -  LEN (N$))
2330  GOTO 2430
2340  IF SN <  > 3 THEN 2400
2350  PRINT "DATE RANGE-MONTH: ";: FOR PF = 1 TO 3: PRINT ".";: NEXT PF: HTAB
     19
2360  INPUT "";M$:
2370  PRINT "DATE RANGE-YEAR: ";: FOR PF = 1 TO 4: PRINT ".";: NEXT PF: HTAB
     18
2380  INPUT "";Y$
2390 N$ =  LEFT$ (M$,3) + "/" +  RIGHT$ (Y$,2): GOTO 2430
2400  PRINT "ISSUE RANGE: ";: FOR PF = 1 TO 3: PRINT ".";: NEXT PF: HTAB
     14
2410  INPUT "";N$: IF  LEN (N$) > 3 THEN  HOME : VTAB 13: PRINT "ISSUE RA
     NGE LIMITED TO 3 DIGITS";: HOME : VTAB 13: GOTO 2400
2420  IF  LEN (N$) < 3 THEN N$ =  LEFT$ (S$,3 -  LEN (N$)) + N$
2430 KN = 1: HOME
2440  FOR J = 1 TO N
2450  IF S1$ = "P" THEN 2470
2460  VTAB KN + 1
2470  PRINT  CHR$ (13);
2480  PRINT D$;"READ TEMPFILE, R";J
```

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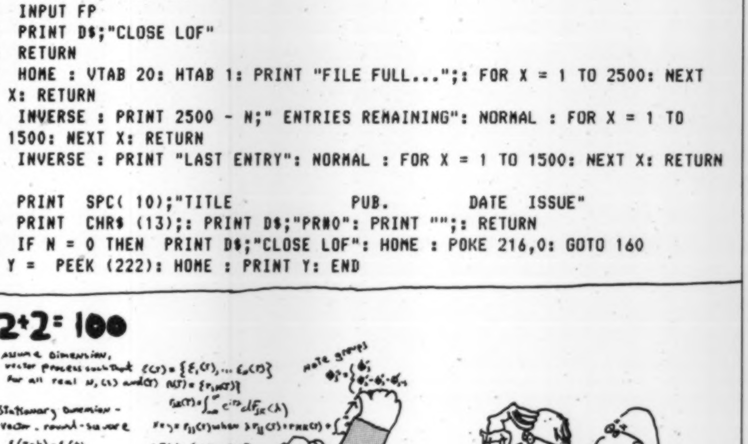
CIRCLE 124 ON READER SERVICE CARD

Comic Relief, continued...

```
2490  INPUT CN$
2500  PRINT  CHR$ (4)
2510  IF SN = 1 AND N$ =  LEFT$ (CN$,15) THEN 2640
2520  IF SN = 2 AND N$ =  MID$ (CN$,16,8) THEN 2640
2530  IF SN = 3 AND N$ =  MID$ (CN$,24,6) THEN 2640
2540  IF SN = 4 AND N$ =  RIGHT$ (CN$,3) THEN 2640
2550  IF SN = 1 AND N$ <  LEFT$ (CN$,15) THEN 2570
2560  NEXT J
2570  IF S1$ = "P" THEN 150
2580  IF FL = 1 THEN 2600
2590  HOME : VTAB 13: PRINT "RANGE NOT CONTAINED IN THIS FILE"
2600  VTAB 24: PRINT "PRESS ´RETURN´ FOR MENU";
2610  GET R$
2620  IF R$ < >  CHR$ (13) THEN 2610
2630 D$ =  CHR$ (13) +  CHR$ (4): HOME : GOTO 180
2640 :
2650  IF S1$ = "P" AND KN = 1 THEN  PRINT D$;"PR#1": PRINT "": PRINT  CHR$
     (13);: GOSUB 2860: GOTO 2670
2660  IF KN = 1 THEN  VTAB KN: HTAB 1: PRINT "TITLE            PUB.
     DATE  ISSUE":KN = KN + 1
2670 FL = 1
2680  IF S1$ = "P" THEN 2700
2690  VTAB KN + 1
2700  IF S1$ = "P" THEN  PRINT D$;"PR#1": PRINT  SPC( 10)
2710  PRINT  LEFT$ (CN$,15) + " "; MID$ (CN$,16,8) + "    "; MID$ (CN$,24
     ,6) + "  "; RIGHT$ (CN$,3)
2720 KN = KN + 1: IF KN = 58 THEN  FOR X = 1 TO 6: PRINT  CHR$ (13);: NEXT
     X:KN = 1
2730  IF S1$ = "P" THEN 2750
2740  IF KN / 21 =  INT (KN / 21) THEN  VTAB 24: HTAB 1: PRINT "PRESS ANY
     KEY TO CONTINUE";: GET L$: HOME :KN = 1: GOTO 2560
2750  IF S1$ = "P" THEN  PRINT D$;"PR#0";: PRINT "";
2760  GOTO 2560
2770  VTAB 24: PRINT "PRESS ´RETURN´ FOR MENU";: INPUT "";R$
2780  PRINT D$;"OPEN LOF"
2790  PRINT D$;"READ LOF"
2800  INPUT FP
2810  PRINT D$;"CLOSE LOF"
2820  RETURN
2830  HOME : VTAB 20: HTAB 1: PRINT "FILE FULL...";: FOR X = 1 TO 2500: NEXT
     X: RETURN
2840  INVERSE : PRINT 2500 - N;" ENTRIES REMAINING": NORMAL : FOR X = 1 TO
     1500: NEXT X: RETURN
2850  INVERSE : PRINT "LAST ENTRY": NORMAL : FOR X = 1 TO 1500: NEXT X: RETURN

2860  PRINT  SPC( 10);"TITLE             PUB.        DATE  ISSUE"
2870  PRINT  CHR$ (13);: PRINT D$;"PR#0": PRINT "";: RETURN
2880  IF N = 0 THEN  PRINT D$;"CLOSE LOF": HOME : POKE 216,0: GOTO 160
2890 Y =  PEEK (222): HOME : PRINT Y: END
```



"My god he proved it, now what will we do?"

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for the Apple II
A source listing of DOS 3.3
Disassembled & commented by Randy Hyde

We used DISASM/65 disassembler program, disassembled Apple's DOS 3.3, and added meaningful lables and comments to create DOSOURCE 3.3, a perfect companion to "Beneath Apple DOS" by Don Worth and Pieter Lechner*. DOSOURCE clearly lists each routine used by Apple DOS.

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by Randy Hyde

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CIRCLE 297 ON READER SERVICE CARD

Home On the Range

Greg Greene

As the rose-tinted clouds bid farewell to the setting sun, the last roll of gunfire echoed out of the range to the nearby mountains. The sixth annual Vancouver Island Police Combat Championships passed into history. This used to be the worst time of the program for all the match officials.

With the final scores coming in to the stats office, and the awards banquet only two hours away, we were faced with an overwhelming task. In this two-hour period, we had to check all the scores, add up the individual aggregates, update the scoreboard and figure out who won what in which class.

At the same time, there would be competitors who had long distances to travel, and who, facing work at 8:00 a.m. the next morning, wished to pick up their prizes and head home.

In such an atmosphere it is easy to make mistakes, and a mistake of a single point out of 1500 could make a difference in the placing of the shooters. This had resulted in misdirected prizes and, of course, hurt feelings in the past.

This year, however, things were different. Even with a smaller number of people running the stats office, all the scores were classified, sorted, and available for display to all the shooters within two minutes of the end of the match. There were no misdirected prizes, nor hurt

Program Listing.

```
50 ' RANGE SCORING PROGRAM
60 ' COPYWRITE 1980 BY
70 ' GREG GREENE
80 ' 207-885 CRAIGFLOWER RD
90 ' VICTORIA BC CANADA V9A 2X4
100 CLEAR 2500
110 DEFINT M,X,I,L,C
120 I=100
130 DIM CN(I),NA$(I),M1(I),M2(I),M3(I),M4(I),M5(I),M6(I)
140 DIM X1(I),X2(I),X3(I),X4(I),X5(I),X6(I)
150 OPEN "I",1,"SCORES.DAT"
160     FOR I=1 TO 100
170     IF EOF(1) THEN 200
180     INPUT #1,CN(I),NA$(I),M1(I),X1(I),M2(I),X2(I),M3(I),X3(I),M4(I),
 -X4(I),M5(I),X5(I),M6(I),X6(I)
190     NEXT I
200 N=I-1
210 CLOSE 1
220 E$=CHR$(27):F$=E$+"E"
230 PRINT F$
240 PRINT TAB(20)"MENU"
250 PRINT:PRINTTAB(15)"1 = ENTER NEW COMPETITOR"
260 PRINT TAB(15)"2 = VIEW COMPETITOR DATA"
270 PRINT TAB(15)"3 = CHANGE DATA"
280 PRINT TAB(15)"4 = SORT DATA"
285 PRINT TAB(15)"5 = STORE DATA"
286 PRINT TAB(15)"6 = PRINT DATA"
290 PRINT :INPUT "CHOICE";CH
300 ON CH GOSUB 1000,2000,3000,4000,5000,6000
310 GOTO 230
350 X2=INT(X/80):Y2=X-(X2*80):PRINT E$+"Y";CHR$(X2+31);CHR$(Y2+32);:RETURN
400 PRINT F$
410 PRINT:PRINT
420 PRINT"CLASS: ";TAB(40)"SCORE:"
430 PRINT"COMP #:"
440 PRINT"7) NAME:"
450 X1=360
460     FOR Y=0 TO 5
470     X=X1+(80*Y):GOSUB 350:PRINT"MATCH";Y+1;"      X'S"
480     NEXT Y
490 RETURN
500 X=768:GOSUB 350:PRINT M1(N+1)+M2(N+1)+M3(N+1)+M4(N+1)+M5(N+1)
```

Greg Greene, #207-885 Craigflower Rd., Victoria BC Canada V9A 2X4.

Getting Acquainted With Your VIC20

Getting Acquainted With Your VIC20 by Tim Hartnell leads the reader, step by simple step, from the absolute basics of programming the VIC to writing complex, sophisticated programs. It thoroughly describes use of the sound, music and color graphics capabilities and illustrates the use of these functions in over 60 programs and games.

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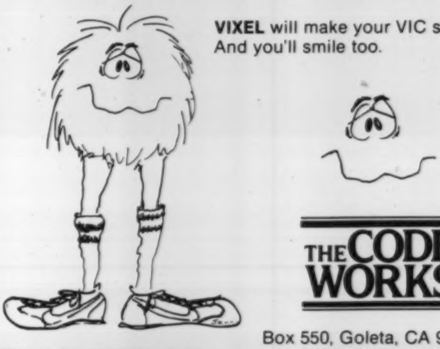

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CIRCLE 326 ON READER SERVICE CARD

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CIRCLE 114 ON READER SERVICE CARD

```
510 X=778:GOSUB 350:PRINT X1(N+1)+X2(N+1)+X3(N+1)+X4(N+1)+X5(N+1)
520 RETURN
600 PRINT "This line changes automatically":RETURN
1000 PRINT F$
1010 PRINT:PRINT
1020 PRINT F$:INPUT "Competitor #";CN
1030 IF CN<200 THEN CL$="GRAND MASTER":CL=100:GOTO 1100
1040 IF CN<300 THEN CL$="DIST MASTER":CL=200:GOTO 1100
1050 IF CN<400 THEN CL$="MASTER":CL=300:GOTO 1100
1060 IF CN<500 THEN CL$="EXPERT":CL=400:GOTO 1100
1070 IF CN<600 THEN CL$="S/S":CL=500:GOTO 1100
1080 IF CN<700 THEN CL$="MKS":CL=600:GOTO 1100
1090 IF CN<800 THEN CL$="UNCLASSIFIED":CL=700:GOTO 1100
1100  PRINT "For classification of ";CL$;" Competitor # must start
with ";CL
1105 INPUT "OK to continue";OK$:IF LEFT$(OK$,1)="Y" THEN 1110
1106 IF LEFT$(OK$,1)<>"y" THEN 1020
1110 GOSUB 400
1115 M=0
1120 X=330:GOSUB 350:PRINT CL$
1130 X=410:GOSUB 350:PRINT CN:CN(N+1)=CN
1140 X=490:GOSUB 350:INPUT NA$(N+1)
1145 IF M=1 THEN RETURN
1150 X=368:GOSUB 350:INPUT M1(N+1):X=378:GOSUB 350:INPUT X1(N+1)
1160 GOSUB 500
1165 IF M=1 THEN RETURN
1170 X=448:GOSUB 350:INPUT M2(N+1):X=458:GOSUB 350:INPUT X2(N+1)
1180 GOSUB 500
1185 IF M=1 THEN RETURN
1190 X=528:GOSUB 350:INPUT M3(N+1):X=538:GOSUB 350:INPUT X3(N+1)
1200 GOSUB 500
1205 IF M=1 THEN RETURN
1210 X=608:GOSUB 350:INPUT M4(N+1):X=618:GOSUB 350:INPUT X4(N+1)
1220 GOSUB 500
1225 IF M=1 THEN RETURN
1230 X=688:GOSUB 350:INPUT M5(N+1):X=698:GOSUB 350:INPUT X5(N+1)
1235 IF M=1 THEN RETURN
1237 M6(N+1)=M1(N+1)+M2(N+1)+M3(N+1)+M4(N+1)+M5(N+1)
1238 X6(N+1)=X1(N+1)+X2(N+1)+X3(N+1)+X4(N+1)+X5(N+1)
1240 INPUT "OK";OK$:IF LEFT$(OK$,1)="Y" OR LEFT$(OK$,1)="y"
THEN N=N+1:RETURN
1245 M=1
1250 INPUT "Line to change";LC
1260 ON LC GOSUB 1150,1170,1190,1210,1230,600,1140
1270 M=0:GOTO 1240
2000 ' VIEW
2002 RE$=""
2005 PRINT "Press 'RETURN' to view, '1' to exit":INPUT RE$
2006 IF RE$<>"" THEN RETURN
2010 GOSUB 400
2020 X=410:GOSUB 350:INPUT CN
2030 FOR L=1 TO N
2040 IF CN(L)=CN THEN 2100
2050 NEXT L
2060 X=800:GOSUB 350:PRINT "Not on file press 'RETURN' to try again"
2070 INPUT RE$
2080 GOTO 2000
2100 X=490:GOSUB 350:PRINT NA$(L)
2110 X=368:GOSUB 350:PRINT M1(L):X=378:GOSUB 350:PRINT X1(L)
2120 X=448:GOSUB 350:PRINT M2(L):X=458:GOSUB 350:PRINT X2(L)
2130 X=528:GOSUB 350:PRINT M3(L):X=538:GOSUB 350:PRINT X3(L)
2140 X=608:GOSUB 350:PRINT M4(L):X=618:GOSUB 350:PRINT X4(L)
2150 X=688:GOSUB 350:PRINT M5(L):X=698:GOSUB 350:PRINT X5(L)
2160 X=768:GOSUB 350:PRINT M6(L)
2165 X=778:GOSUB 350:PRINT X6(L)
2170 PRINT:INPUT "Press 'RETURN' when done";RE
2180 GOTO 2000
3000 ' CHANGE DATA
3005 RE$=""
3010 PRINT F$:PRINT "Change data section- press'RETURN' to continue,
'1' to exit"
3020 INPUT RE$
3030 IF RE$<>"" THEN RETURN
3040 INPUT "Competitor number to change ";CN
3050 GOSUB 400
3060 FOR L=1 TO N
3070 IF CN=CN(L) THEN 3100
3080 NEXT L
3090 X=800:GOSUB 350:INPUT "Not on file, press 'RETURN' to try again"
;RE$:GOTO 3 010
3100 X=490:GOSUB 350:PRINT NA$(L)
3110 X=368:GOSUB 350:PRINT M1(L):X=378:GOSUB 350:PRINT X1(L)
3120 X=448:GOSUB 350:PRINT M2(L):X=458:GOSUB 350:PRINT X2(L)
3130 X=528:GOSUB 350:PRINT M3(L):X=538:GOSUB 350:PRINT X3(L)
3140 X=608:GOSUB 350:PRINT M4(L):X=618:GOSUB 350:PRINT X4(L)
3150 X=688:GOSUB 350:PRINT M5(L):X=698:GOSUB 350:PRINT X5(L)
3160 X=768:GOSUB 350:PRINT M6(L)
3170 X=778:GOSUB 350:PRINT X6(L)
```

feelings, and we all made it to the banquet hall, six miles away in plenty of time.

What was the difference, you ask. Right: it was a computer. I spent a great deal of time analyzing what went on in the stats office, and programming my computer to take over as much of the work load as possible.

To see how all this came to pass, let's take a look at the information which is gathered in the stats office of a combat shoot, and what is done with it.

At a police combat shoot the entrants compete to see who can shoot the most accurately in a specified time. To separate the better and more experienced shooters from those just beginning, there are seven classes: The most experienced enter the Grand Master class and the beginners start at the Unclassified level. As a shooter becomes more proficent he moves up so that he is always competing against those of similar skill.

Each competitor fires in five matches, the scores of these five individual matches are added to get the shooter's aggregate score, which determines where he places in his class. What we need for the scoring program then, is a way to determine who is in what class, their scores in each of the five matches, and the total of the matches.

To determine his class, each competitor presents a classification card issued by the governing body of the sport. In Canada this is the Canadian Police Combat Association (C.P.C.A.), and in the United States, the National Rifle Association (N.R.A.). Those competing as Grand Masters are assigned numbers from 100 to 199. Those in the lowest class receive numbers from 700 to 799.

An array is dimensioned for each competitor in each class. For example if there were 100 shooters, the array for match one would be M1(100), for match two M2(200) etc. Match 6 is an aggregate of the previous five matches, and is updated with any additions and corrections from them. This allows a running score to be kept.

With the running total, there is no last minute adding of scores to come up with an aggregate. At the conclusion of the match, or at any other time, the option of a sort is available. This routine sorts all the data using the aggregate score as a key. The result is a listing from the highest to the lowest of all the competitors in the shoot.

To obtain the standings in a particular class, another routine goes through the data list from the top to the bottom and searches for a competitor number within the range of the desired class. When found, this is outputted to the screen or printer. Since the results have already been sorted, the display lists the finishing places in order: first, second, third, etc.

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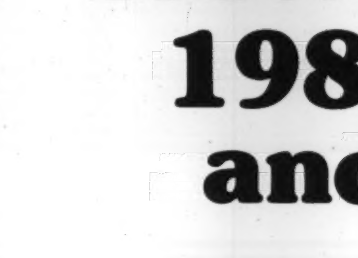
1981: Blister Ball and Mad Bomber

Blister Ball

Blister Ball is the first completely original arcade-type game for a computer. Not a copy, not an adaptation, not a spinoff. **Blister Ball** is new—it's a new idea—better than Invaders, better than Circus, better than Asteroids, better than Galaxian. If you've played other games for hours, you'll play **Blister Ball** for days.



How does it work? Well, some mean but fun-loving aliens have produced some bouncing bombs. First they drop one and you've got to position yourself under it and zap it with your laser. If you miss, that's OK. It will bounce around, although each bounce is lower, and you have several chances to zap it. Got the hang of it? OK, here come two bouncing bombs. You zap them. Then you're faced with three, then four and five.

As they bounce longer and longer the walls begin to close in so you're faced with either zapping the bombs or being hit. Each hit knocks you a little further toward the gutter. But you can survive two hits which is usually enough to zap all the bombs.

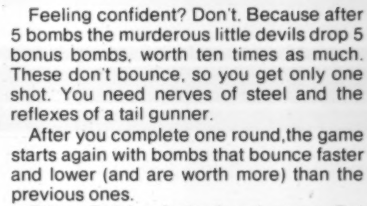
Feeling confident? Don't. Because after 5 bombs the murderous little devils drop 5 bonus bombs, worth ten times as much. These don't bounce, so you get only one shot. You need nerves of steel and the reflexes of a tail gunner.

After you complete one round, the game starts again with bombs that bounce faster and lower (and are worth more) than the previous ones.

Blister Ball is a fantastic solo game. But there are two-player options as well in which players can play as a team or as opponents. Each player can move the entire width of the screen and zap any of the bombs. Here, you're not only trying to survive, but trying to outscore your opponent. The game has two skill levels.

Mad Bomber

In **Mad Bomber** you are faced with aliens in a huge ship hovering overhead. They have bomb racks which they constantly fill with bombs. Your object is to move from side to side on the ground and zap the bombs in the bomb racks or as they fall.



As the game progresses, the aliens fill up their bomb racks more quickly and the bombs fall faster. You lose after ten bombs have hit the area which you are defending.

Mad Bomber can be played by one player solo or by two players as a team or as opponents. Two skill levels.

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Blister Ball and **Mad Bomber** are available together for $24.95 on disk (DOS 3.2) only and require a 48K Apple with paddle controls. (We recommend using the Super Paddles from Peripherals Plus).

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Blister Ball and **Mad Bomber** are colorful, challenging, fast and noisy. They are the games of the year from Sensational Software.

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CIRCLE 350 ON READER SERVICE CARD

On the Range, continued...

```
3180 PRINT:PRINT:INPUT "Line # to change";LN
3182 IF LN<0 OR LN>7 THEN 3180
3185 IF LN=0 THEN 3000
3187 M=1
3190 ON LN GOSUB 3210,3220,3230,3240,3250,600,3260
3200 M=0:GOTO 3100
3210 X=368:GOSUB 350:INPUT M1(L):X=378:GOSUB 350:INPUT X1(L)
3215 GOTO 3270
3220 X=448:GOSUB 350:INPUT M2(L):X=458:GOSUB 350:INPUT X2(L)
3225 GOTO 3270
3230 X=528:GOSUB 350:INPUT M3(L):X=538:GOSUB 350:INPUT X3(L)
3235 GOTO 3270
3240 X=608:GOSUB 350:INPUT M4(L):X=618:GOSUB 350:INPUT X4(L)
3245 GOTO 3270
3250 X=688:GOSUB 350:INPUT M5(L):X=698:GOSUB 350:INPUT X5(L)
3255 GOTO 3270
3260 X=490:GOSUB 350:INPUT NA$(L):RETURN
3270 M6(L)=M1(L)+M2(L)+M3(L)+M4(L)+M5(L):X=768:GOSUB 350:PRINT M6(L)
3280 X6(L)=X1(L)+X2(L)+X3(L)+X4(L)+X5(L):X=778:GOSUB 350:PRINT X6(L)
3290 RETURN
4000 ' sort
4010 PRINT F$
4020 PRINT "This section sorts data by the aggregate score (match 6)"
4025 S=0
4030 FOR L=1 TO N-1
4040 IF M6(L)=>M6(L+1) THEN 4195
4045 PRINT M6(L),M6(L+1),L
4050 SWAP NA$(L),NA$(L+1)
4060 SWAP CN(L),CN(L+1)
4070 SWAP M1(L),M1(L+1)
4080 SWAP X1(L),X1(L+1)
4090 SWAP M2(L),M2(L+1)
4100 SWAP X2(L),X2(L+1)
4110 SWAP M3(L),M3(L+1)
4120 SWAP X3(L),X3(L+1)
4130 SWAP M4(L),M4(L+1)
4140 SWAP X4(L),X4(L+1)
4150 SWAP M5(L),M5(L+1)
4160 SWAP X5(L),X5(L+1)
4170 SWAP M6(L),M6(L+1)
4180 SWAP X6(L),X6(L+1)
4190 S=1
4195 NEXT L
4196 PRINT L1:L1=L1+1
4197 IF L1=N THEN RETURN
4200 IF S=1 THEN 4025
4210 RETURN
5000 ' STORE
5010  CLOSE 1
5015 OPEN "O",1,"SCORES.DAT"
5020 FOR L=1 TO N
5030 PRINT #1,CN(L);NA$(L);",";M1(L);X1(L);M2(L);X2(L);M3(L);X3(L);M4(L);
X4(L);M 5(L);X5(L);M6(L);X6(L)
5040 NEXT L
5050 CLOSE 1
5060 RETURN
6000 ' PRINT OUT
6005 T$="###     \                  \  ### ##  ### ##  ### ##  ### ##
 ### ##  ####  ###"
6010 PRINT F$
6020 PRINT "This section offers you a print-out by various classes"
6030 PRINT:PRINT"1 = All"
6040 PRINT"2 = Grand Master"
6050 PRINT"3 = Distinguished Master"
6060 PRINT"4 = Master"
6070 PRINT"5 = Expert"
6080 PRINT"6 = Sharpshooter"
6090 PRINT"7 = Marksman"
6100 PRINT"8 = Unclassified"
6110 PRINT:PRINT
6120 INPUT "Choice";PO
6122 IF PO=1 THEN PO=1000:GOTO 6140
6125 PO=PO-1
6130 PO=PO*100
6140 PRINT:INPUT "Screen (1) or Printer (2)";P1
6150 IF P1>1 THEN P$="AT:" ELSE P$="TT:"
6160 OPEN "O",2,P$
6170 PRINT #2,TAB(20)"Range scores "
6180 PRINT #2,TAB(20)"by- Greg Greene"
6190 PRINT#2,:PRINT#2,
6195 PRINT #2,"COMP#      NAME                MCH 1   MCH 2   MCH 3   MCH 4
MCH 5  MCH 6"
6197 PRINT #2,STRING$(80,"-")
6198 PRINT #2,
6200 FOR L=1 TO N
6205 IF PO=1000 THEN GOSUB 6300:GOTO 6220
6206 N9=CN(L):N9=N9/100
6207 N9=INT(N9)
6208 N9=N9*100
```

The system I used was a Heathkit H-8 computer, with 56K of memory. Less memory is required for fewer participants. Dual disks were available, but only one is needed. An H19 terminal was used for its direct cursor addressing ability and excellent keyboard. I had a Printec-100 printer at home, but since it weighs 111 lbs., I didn't take it to the range.

The program ran smoothly for two days without being shut off, and without any problems. In fact, after a short, five-minute training session two novices were doing all the data entry tasks for me. They decided it was much more fun to use a computer than to write it all down.

The use of the computer for this application saved a great deal of time and frustration on the part of the range personnel and match officials. The competitors liked the convenience of knowing their scores up to the minute, and enjoyed seeing a computer doing something other than playing StarTrek.

The Program

The program is written in Vers 4.7 of Microsoft Basic as sold by Heath for use on the H8 and H89 computers. I believe that it is compatible with most of the current versions that are available on a variety of other micros most notably the TRS-80. In fact, except for the screen commands, MBasic for the Heath machines, and TRS-80 Basic are almost identical. (Graphic and the special time commands are either different or not available.)

Line 100 clears an area in memory for string use.

Line 110 sets certain variables to integers for speed.

In Line 120 'I' is the value that represents the maximum number of shooters. In this program it is set to 100.

Line 150 reads in old score data.

Lines 230-300 clear the screen and print the menu.

Lines 400-600 set up various screen 'masks.'

Lines 1000-1270 Input scores for various classes.

Lines 2000-2180 view a particular competitor's score.

Lines 3000-3290 allow modification of the database.

Lines 4000-4210 sort the score using the aggregate score as a key.

Lines 5000-5060 store the database on the disk.

Lines 6000-6310 print out the various classes of scores—or all of them—on a printer or on the screen.

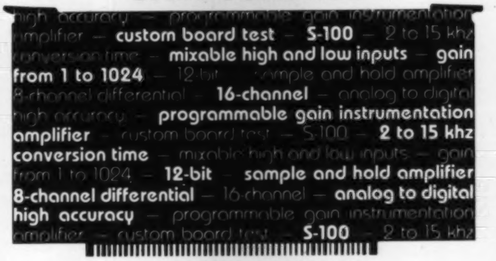
Using the Program

The program is very simple to use. Each competitor is given a number, the number he gets depends on which class he shoots under according to the following chart:

ANALOG ⟺ DIGITAL
DIGITAL ⟺ ANALOG

CONVERSION MODULES

SOFTWARE GAIN CONTROL


high accuracy — programmable gain instrumentation amplifier — custom board test — S-100 — 2 to 15 khz conversion time — mixable high and low inputs — gain from 1 to 1024 — 12-bit — sample and hold amplifier 8-channel differential — 16-channel — analog to digital high accuracy — programmable gain instrumentation amplifier — custom board test — S-100 — 2 to 15 khz conversion time — mixable high and low inputs — gain from 1 to 1024 — 12-bit — sample and hold amplifier 8-channel differential — 16-channel — analog to digital high accuracy — programmable gain instrumentation amplifier — custom board test — S-100 — 2 to 15 khz

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CIRCLE 125 ON READER SERVICE CARD

On the Range, continued...

```
6210 IF N9=PO THEN GOSUB 6300
6220 NEXT
6230 PRINT #2,:PRINT #2,"Print-out complete"
6240 CLOSE #2
6250 INPUT "When done press 'RETURN'";RE$
6260 RETURN
6300 PRINT #2,USING T$;CN(L);NA$(L);M1(L);X1(L);M2(L);X2(L);M3(L);X3(L);
M4(L);X4(L);M5(L);X5(L);M6(L);X6(L)
6310 RETURN
```

Sample Run

```
402    JAY SADLER          236 17   174  6   220  2   231  4   588 25   1449  54
401    KEN CLARKE          239 16   175  6   230  2   228  7   576 17   1448  48
508    BILL BILLSON        239 18   178  7   222  2   225  4   582 23   1446  54
404    BOB PENTLAND        234 13   179  8   225  6   227  6   580 23   1445  56
306    GARY DALTON         240 18   175  5   222  1   233  7   573 18   1443  49
305    DAVE HOLBECHE       239 18   177  7   213  3   234  7   580 23   1443  58
403    DON ROSS            237 17   174  6   219  2   231  7   582 23   1443  55
605    GEORGE WARD         238 15   170  4   219  2   232  5   580 17   1439  43
307    GLENN BARRY         239 16   175  5   225  7   227  8   573 20   1439  56
510    KEN MORRIS          238 11   176  5   224  5   217  5   577 23   1432  49
513    MIKE DRESCHER       234 12   170  2   214  3   233  4   571 13   1422  34
613    BOB EMERY           237 12   174  5   207  2   228  5   575 25   1421  49
612    GLEN FROM           237 14   172  5   205  0   234 11   570 28   1418  58
302    ROBERT ANGLE        236 14   173  4   220  0   221 10   568 22   1418  50
102    GLENN BOATMAN       240 14   133  7   225  6   231 10   587 30   1416  67
514    KEN SCHENDEL        238 13   171  3   222  3   229  6   556 12   1416  37
611    GREG MCKINNON       238 17   176  6   216  4   227  3   555 18   1412  48
607    ERNIE KREEFT        238 10   174  6   216  2   225  5   557 19   1410  42
502    LARRY JOHNSTON      232 12   164  2   218  5   224  6   569 19   1407  44
610    IAN MACDONALD       236 13   158  2   217  2   232  4   564 18   1407  39
501    JIM DUECK           236 12   173  2   202  2   226  5   564 15   1401  36
507    DOLPHUS PETERSON    235  9   166  0   202  1   230  7   563 18   1396  35
407    JOHN CHARLTON       236 18   176  7   167  3   235  7   578 32   1392  67
503    LOUIS GAAL          230  8   172  3   172  0   227  5   565 20   1366  36
512    HUGH MCCLELLAND     236  9   163  1   210  2   206  3   545 18   1360  33
405    DAVE CROSWELL       236 11   169  5   194  1   221  5   539 15   1359  37
704    RAY COTTINGHAM      238 11   173  4   195  2   214  1   535 11   1355  29
603    KAREN HUTCHINSON    201  5   178  6   210  5   207  2   545 16   1341  34
614    RICHIE MARTIN       230  5   159  0   190  1   217  1   517  9   1313  16
509    MAURICE PARKER      232 11   176  5   179  0   175  4   543 17   1305  37
609    FRED GRABAS         207  6   158  0   172  1   221  5   537 16   1295  28
601    MIKE SIKORA         230  7   169  2   186  1   189  2   517 15   1291  27
608    DAN BENDETT         224  6   160  0   195  0   205  1   501  6   1285  13
```

```
                         RANGE SCORES
                         BY- GREG GREENE

COMP#      NAME             MCH 1    MCH 2    MCH 3    MCH 4    MCH 5     MCH 6
--------------------------------------------------------------------------------

101    BOB LANDRETH        240 21   180 14   236 14   239 18   596 36   1491 103
102    GLENN BOATMAN       240 14   133  7   225  6   231 10   587 30   1416  67

PRINT-OUT COMPLETE
                      RANGE SCORES
                      BY- GREG GREENE

COMP#      NAME             MCH 1    MCH 2    MCH 3    MCH 4    MCH 5     MCH 6
--------------------------------------------------------------------------------

204    GARY CRANE          240 19   178  9   236 10   233  8   589 30   1476  76
201    GREG GREENE         240 22   180 12   230  9   233  9   588 32   1471  94
203    MIKE HENRY          239 19   178  9   231  4   234 11   589 35   1471  78
202    DAVE CHURCH         240 20   177 12   223  2   233 10   580 24   1453  68

PRINT-OUT COMPLETE
                      RANGE SCORES
                      BY- GREG GREENE

COMP#      NAME             MCH 1    MCH 2    MCH 3    MCH 4    MCH 5     MCH 6
--------------------------------------------------------------------------------

301    DAVE CHILSON        239 19   177 10   229  3   235 12   592 37   1472  81
308    BILL DAVENPORT      238 21   180 16   230  8   233  8   580 33   1461  86
304    DOUG CHADWICK       236 13   177  9   229  6   233  8   581 27   1456  63
303    SEBASTIAN COCO      238 16   175  9   225  3   229  3   587 26   1454  57
306    GARY DALTON         240 18   175  5   222  1   233  7   573 18   1443  49
305    DAVE HOLBECHE       239 18   177  7   213  3   234  7   580 23   1443  58
307    GLENN BARRY         239 16   175  5   225  7   227  8   573 20   1439  56
302    ROBERT ANGLE        236 14   173  4   220  0   221 10   568 22   1418  50

PRINT-OUT COMPLETE
```

Grand Master	100-199
Dist. Master	200-299
Master	300-399
Expert	400-499
Sharpshooter	500-599
Marksman	600-699
Unclassified	700-799

Each competitor has his score entered as it comes in. Individual scores may be viewed by selecting that section of the program from the menu and inputting the competitor's number. At the end of the shoot the database should be sorted a final time, stored on the disk, and printed out as required.

The database is stored in the program as an array, and all operations are carried out on it while it is resident in memory. Thus, frequent storing of the database will prevent total loss of data if the power should fail. Of course having the data in memory places a logical restriction on the number of shooters you can have. I use a 56K memory on my Heath H8 with no problem, your memory space may limit you to less than 100 competitors.

The sorting algorithm is just a plain bubble sort, however I have found it to be fast enough for use in this program. If you want to change it to a S/M or other type of sort; feel free.

Conclusion

Since its initial use at our match, I have received invitations to use this program at the Canadian National Combat Championships in Edmonton, Alberta, as well as the Provincial Championships in Vancouver, British Columbia.

There are a few ideas I'd like to pass on. Although this article is about the use of my computer at a Revolver Shoot, there are similar applications in almost any sporting event where a large number of people are involved. Such sports as archery, rifle shooting, golf, bowling, etc., come to mind, and I'm sure you can think of others. These are great places to get the club spirit out into the open and really put on a display.

Solid programming and practical uses will bring many more people into personal computing. If you can add a couple of TV monitors for display of data, and maybe a remote terminal that the competitors can use to query the database, the possibilities are endless. At the very least you will have a lot of fun, provide a needed service, and make a lot of great friends. Go for it!!

Editor's Note: It is essential in an application such as this to have the computer print out the data as hard copy immediately upon entering it, or to keep a manual copy of the scores. Otherwise, if someone trips over the power cable during the final sort... —GWB ☐

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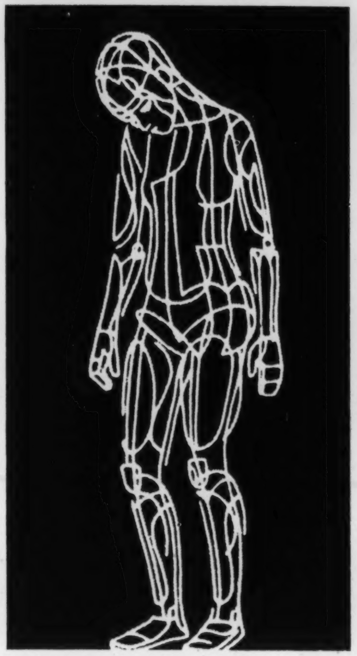
Smokers Self-Assessment Test

John G. Sparti

This program is based on a smokers self-assessment test, "algorithm." This was written in Basic for the Polymorphic System 8813 with 48K RAM. I have used it in my office and have found that the patients are able to follow directions and are fascinated with the hard copy output. I am making this available to all doctors who have access to a mini, or personal computer. I feel it is a good medical application for in-office use, and I believe it helps to deal with a very serious problem in patient care.

I hope you will find the self-assessment test interesting. □

Dr. John G. Sparti, 318 Main St., Dallas, GA 30132.



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```
10 ON ERROR GOTO 2590
20 REM "WHY SMOKE" ORIGINAL MATERIAL
30 REM BY ARDEN G. CHRISTEN D.D.S.
40 REM AND KENNETH H. COOPER M.D. "STRATEGIC WITHDRAWAL FROM
50 REM CIGARETTE SMOKING" MARCH/APRIL  1979
60 REM FROM "CA-A CANCER JOURNAL FOR CLINICIANS"
70 REM BY JOHN G. SPARTI D.O. & ROGER FORD  BASIC XXX  5/16/79
80 REM POLYMORPHIC SYSTEMS 8813 & 88/MS - DECWRITER II
90 REM 318 MAIN/DALLAS, GA. 30132  :  404-445-5555
100 REM THIS PROGRAM IS TO BE USED FREELY BY ALL (PUBLIC DOMAIN)
110 REM NO GUARANTEE IMPLIED IN THE USE OF THIS MATERIAL!
120 PRINT CHR$(12)
130 PRINT "          WHY DO YOU SMOKE? "
140 PRINT "HERE ARE SOME STATEMENTS MADE BY PEOPLE TO"
150 PRINT "DESCRIBE WHAT THEY GET OUT OF SMOKING CIGARETTES."
160 PRINT "HOW OFTEN DO YOU FEEL THIS WAY ",
170 PRINT "WHEN ARE YOU SMOKING THEM?"
180 PRINT "TO ANSWER THE UPCOMING QUESTIONS, USE THE FOLLOWING"
190 PRINT "NUMBERS. ALWAYS=5  FREQUENTLY=4  OCCASIONALLY=3"
200 PRINT "SELDOM=2 NEVER=1   (THEN HIT RETURN)."
210 PRINT  "(Note:The Above will  appear  on every question)"
220 PRINT "(IMPORTANT PLEASE ANSWER EVERY QUESTION)."
230 PRINT "(TYPE ANY 'LETTER' TO CONTINUE)",
240 WAIT
250 GOSUB 2640
260 PRINT "I SMOKE CIGARETTES IN ORDER TO KEEP MYSELF FROM"
270 PRINT "SLOWING DOWN",\GOSUB 2670\A=Z1
280 GOSUB 2640
290 PRINT "HANDLING A CIGARETTE IS PART OF THE ENJOYMENT"
300 PRINT "OF SMOKING IT",\GOSUB 2670\B=Z1
310 GOSUB 2520
320 PRINT "SMOKING CIGARETTES IS PLEASANT AND RELAXING ",
330 GOSUB 2670\C=Z1
340 GOSUB 2640
350 PRINT "I LIGHT UP A CIGARETTE WHEN I FEEL ANGRY"
360 PRINT "ABOUT SOMETHING",\GOSUB 2670\D=Z1
370 GOSUB 2640
380 PRINT "WHEN I HAVE RUN OUT OF CIGARETTES I FIND IT"
390 PRINT "ALMOST UNBEARABLE UNTIL I CAN GET THEM",
400 GOSUB 2670\E=Z1
410 GOSUB 2640
420 PRINT "I SMOKE CIGARETTES AUTOMATICALLY WITHOUT"
430 PRINT "EVEN BEING AWARE OF IT",\GOSUB 2670\F=Z1
440 GOSUB 2640
450 PRINT "I SMOKE CIGARETTES TO STIMULATE ME, TO PERK"
460 PRINT "MYSELF UP",\GOSUB 2670\G=Z1
470 GOSUB 2640
480 PRINT "PART OF THE ENJOYMENT OF SMOKING A CIGARETTE"
490 PRINT "COMES FROM THE STEPS I TAKE TO LIGHT UP",
500 GOSUB 2670\H=Z1
510 GOSUB 2640
520 PRINT "I FIND CIGARETTES PLEASURABLE",\GOSUB 2670\I=Z1
530 GOSUB 2640
540 PRINT "WHEN I FEEL UNCOMFORTABLE OR UPSET ABOUT"
550 PRINT "SOMETHING I LIGHT UP A CIGARETTE",\GOSUB 2670\J=Z1
560 GOSUB 2640
570 PRINT "I AM VERY MUCH AWARE OF THE FACT WHEN I AM NOT"
580 PRINT "SMOKING A CIGARETTE",\GOSUB 2670\K=Z1
590 GOSUB 2640
600 PRINT "I LIGHT UP A CIGARETTE WITHOUT REALIZING I STILL"
610 PRINT "HAVE ONE BURNING IN THE ASHTRAY",\GOSUB 2670\L=Z1
620 GOSUB 2640
630 PRINT "I SMOKE CIGARETTES TO GIVE ME A 'LIFT'",\GOSUB 2670
640 M=Z1
650 GOSUB 2640
660 PRINT "WHEN I SMOKE A CIGARETTE, PART OF THE ENJOYMENT"
670 PRINT "IS WATCHING THE SMOKE AS I EXHALE IT",
680 GOSUB 2670\N=Z1
690 GOSUB 2640
700 PRINT "I WANT A CIGARETTE MOST WHEN I AM COMFORTABLE"
710 PRINT "AND RELAXED",\GOSUB 2670\O=Z1
720 GOSUB 2640
730 PRINT "WHEN I FEEL 'BLUE' OR WANT TO TAKE MY MIND OFF"
740 PRINT "CARES AND WORRIES, I SMOKE CIGARETTES",
750 GOSUB 2670\P=Z1
760 GOSUB 2640
770 PRINT "I GET A REAL GNAWING HUNGER FOR A CIGARETTE"
780 PRINT "WHEN I HAVEN'T SMOKED FOR A WHILE",
790 GOSUB 2670\Q=Z1
800 GOSUB 2640
810 PRINT "I'VE FOUND A CIGARETTE IN MY MOUTH AND DIDN'T"
820 PRINT "REMEMBER PUTTING IT THERE",\GOSUB 2670\R=Z1
830 S=A+G+M\H1=B+H+N
840 P1=C+I+O\C1=D+J+P
850 C2=E+K+Q\H2=F+L+R
860 PRINT CHR$ (12)
870 PRINT "SCORES OF 11 OR ABOVE INDICATE THAT THIS FACTOR IS"
880 PRINT "AN IMPORTANT SOURCE OF SATISFACTION FOR THE SMOKER."
890 PRINT "SCORES OF 7 OR LESS ARE LOW AND PROBABLY INDICATE"
900 PRINT "THAT THIS FACTOR DOES NOT APPLY TO YOU."
910 PRINT "SCORES IN BETWEEN ARE MARGINAL."
920 PRINT
930 IF S>=10.5  THEN PRINT "YOUR STIMULATION SCORE IS ",S
940 IF H1>=10.5 THEN PRINT "YOUR HANDLING SCORE IS ",H1
```

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Smokers Test, continued...

```
950 IF P1<10.5 THEN 970
960 PRINT "YOUR PLEASURABLE RELAXATION SCORE IS ",P1
970 IF C1<10.5 THEN 990
980 PRINT "YOUR CRUTCH: TENSION  REDUCTION SCORE IS ",C1
990 IF C2<10.5 THEN 1010
1000 PRINT "YOUR CRAVING: PSYCHOLOGICAL ADDICTION SCORE IS ",C2
1010 IF H2>=10.5 THEN PRINT "YOUR HABIT SCORE IS ",H2
1020 FILE:2,LIST
1030 PRINT:2,CHR$(12),TAB(30),""***  Report ***"
1040 PRINT:2,"YOUR STIMULATION SCORE IS ",S
1050 PRINT:2,"YOUR HANDLING SCORE IS ",H1
1060 PRINT:2,"YOUR PLEASURE RELAXATION SCORE IS ",P1
1070 PRINT:2,"YOUR CRUTCH: TENSION REDUCTION SCORE IS ",C1
1080 PRINT:2,"YOUR CRAVING: PSYCHOLOGICAL ",
1090 PRINT:2,"ADDICTION SCORE IS ",C2
1100 PRINT:2,"YOUR HABIT SCORE IS ",H2
1110 PRINT:2," "
1120 PRINT:2,"SCORES OF 11 OR ABOVE INDICATE THAT THIS FACTOR"
1130 PRINT:2,"IS AN IMPORTANT SOURCE OF SATISFACTION FOR YOU"
1140 PRINT:2,"THE SMOKER.SCORES BETWEEN 7 AND 11 ARE MARGINAL"
1150 PRINT:2,"SCORES OF 7 OR LESS INDICATE THAT THESE FACTORS"
1160 PRINT:2,"PROBABLY DO NOT APPLY TO YOU."
1170 PRINT:2," "
1180 IF S<7.5 THEN 1240
1190 IF S<10.5 THEN 1220
1200 PRINT:2,"STIMULATION IS AN IMPORTANT SOURCE OF"
1210 GOTO 1230
1220 PRINT:2,"STIMULATION IS A MARGINAL SOURCE OF"
1230 PRINT:2,"SATISFACTION FOR YOU."\GOTO 1270
1240 PRINT:2,"SINCE STIMULATION IS NOT AN IMPORTANT FACTOR TO"
1250 PRINT:2,"YOU, THE FOLLOWING PARAGRAPH PROBABLY DOESN'T"
1260 PRINT:2,"APPLY TO YOU."
1270 PRINT:2,"STIMULATION (10% OF SMOKERS) THIS TYPE OF SMOKER"
1280 PRINT:2,"IS STIMULATED BY THE CIGARETTE.  IT HELPS HIM TO"
1290 PRINT:2,"WAKE UP IN THE MORNING, TO ORGANIZE HIS ENERGIES"
1300 PRINT:2,"AND TO KEEP HIM GOING.  MANY SMOKERS  REPORT"
1310 PRINT:2,"THAT WHILE SMOKING THEY EXPERIENCE A SHARPENING"
1320 PRINT:2,"OF INTELECTUAL CAPACITY AND AN INCREASE IN"
1330 PRINT:2,"IMPULSE CONTROL."
1340 PRINT:2," "
1350 IF H1<7.5 THEN 1410
1360 PRINT:2,"IF H1<10.5 THEN 2710
1370 PRINT:2,"HANDLING IS AN IMPORTANT SOURCE OF SATISFACTION"
1380 PRINT:2,"FOR YOU."\GOTO 1440
1390 PRINT:2,"HANDLING IS A MARGINAL SOURCE OF SATISFACTION"
1400 PRINT:2,"FOR YOU."\GOTO 1440
1410 PRINT:2,"SINCE HANDLING IS NOT AN IMPORTANT FACTOR TO"
1420 PRINT:2,"YOU, THE FOLLOWING PARAGRAPH PROBABLY DOESN'T"
1430 PRINT:2,"APPLY TO YOU."
1440 PRINT:2,"HANDLING: SENSORIMOTOR MANIPULATION (10%)"
1450 PRINT:2,"THIS TYPE ENJOYS MANIPULATING THE CIGARETTE"
1460 PRINT:2,"WITH HIS HANDS, WATCHING THE SMOKE CURL AS HE"
1470 PRINT:2,"EXHALES, AND MAKING A PRODUCTION OF LIGHTING"
1480 PRINT:2,"THE CIGARETTE, HOLDING IT, AND FLICKING THE"
1490 PRINT:2,"ASHES."
1500 PRINT:2," "
1510 IF P1<7.5 THEN 1570
1520 IF P1<10.5 THEN 1550
1530 PRINT:2,"PLEASUREABLE RELAXATION IS AN IMPORTANT SOURCE"
1540 PRINT:2,"OF SATISFACTION FOR YOU."\GOTO 1600
1550 PRINT:2,"PLEASUREABLE RELAXATION IS A MARGINAL SOURCE OF"
1560 PRINT:2,"SATISFACTION FOR YOU."\GOTO 1600
1570 PRINT:2,"SINCE PLEASURABLE RELAXATION IS NOT AN IMPORTANT"
1580 PRINT:2,"FACTOR TO YOU, THE FOLLOWING PARAGRAPH PROBABLY"
1590 PRINT:2,"DOESN'T APPLY TO YOU."
1600 PRINT:2,"PLEASUREABLE RELAXATION (15%)."
1610 PRINT:2,"THIS SMOKER GETS REAL, HONEST PLEASURE FROM"
1620 PRINT:2,"SMOKING, ESPECIALLY AFTER A DINNER OR WITH A"
1630 PRINT:2,"COCKTAIL.  HE TENDS TO SMOKE TO ACCENTUATE OR"
1640 PRINT:2,"ENHANCE PLEASURABLE FEELINGS ACCOMPANYING A"
1650 PRINT:2,"STATE OF WELL BEING."
1660 PRINT:2," "
1670 PRINT:2,"THE ABOVE SMOKERS CHARACTERISTICALLY SMOKE "
1680 PRINT:2,"UNDER PLEASANT CIRCUMSTANCES THAT ARE RELAXING."
1690 PRINT:2,"THEY USUALLY REQUIRE AN ADEQUATE SUBSTITUTE FOR"
1700 PRINT:2,"QUITTING AND OFTEN FIND THAT IT IS NOT TOO "
1710 PRINT:2,"DIFFICULT TO STOP."
1720 PRINT:2," "
1730 IF C1<7.5 THEN 1790
1740 IF C1<10.5 THEN 1770
1750 PRINT:2,"CRUTCH:TENSION REDUCTION IS AN IMPORTANT SOURCE"
1760 PRINT:2,"OF SATISFACTION FOR YOU."\GOTO 1820
1770 PRINT:2,"CRUTCH: TENSION REDUCTION IS A MARGINAL SOURCE"
1780 PRINT:2,"OF SATISFACTION FOR YOU."\GOTO 1820
1790 PRINT:2,"SINCE CRUTCH: TENSION REDUCTION IS NOT AN"
1800 PRINT:2,"IMPORTANT FACTOR TO YOU, THE FOLLOWING PARAGRAPH"
1810 PRINT:2,"PROBABLY DOESN'T APPLY TO YOU."
1820 PRINT:2,"CRUTCH: TENSION REDUCTION (30%)."
1830 PRINT:2,"THIS NEGATIVE-AFFECT TYPE OF SMOKER USES"
1840 PRINT:2,"CIGARETTES FOR THE SEDATIVE OR TRANQUILIZER"
1850 PRINT:2,"EFFECT IN MOMENTS OF STRESS, FEAR, SHAME,"
1860 PRINT:2,"DISGUST, DISCOMFORT, OR PRESSURE.  HE USES"
1870 PRINT:2,"CIGARETTES TO HELP HIM COPE WITH PROBLEMS."
1880 PRINT:2,"SUBSTITUTIONS WILL GENERALLY NOT HELP THIS"
1890 PRINT:2,"SMOKER, AND SUCCESS IS GAINED FROM LEARNING"
1900 PRINT:2,"HOW TO PROPERLY MANAGE THE SITUATIONS THAT"
1910 PRINT:2,"PRODUCE THE BAD FEELINGS IN THE FIRST PLACE."
1920 PRINT:2," "
1930 IF C2<7.5 THEN 1990
1940 IF C2<10.5 THEN 1970
1950 PRINT:2,"CRAVING: PSYCHOLOGICAL ADDICTION IS AN IMPORTANT"
1960 GOTO 1980
1970 PRINT:2,"CRAVING: PSYCHOLOGICAL ADDICTION IS A MARGINAL"
1980 PRINT:2,"SOURCE OF SATISFACTION FOR YOU."\GOTO 2020
1990 PRINT:2,"SINCE CRAVING: PSYCHOLOGICAL ADDICTION IS NOT AN"
2000 PRINT:2,"IMPORTANT FACTOR TO YOU, THE FOLLOWING PARAGRAPH"
2010 PRINT:2,"PROBABLY DOESN'T APPLY TO YOU."
2020 PRINT:2,"CRAVING: PSYCHOLOGICAL ADDICTION (25%). "
2030 PRINT:2,"THIS TYPE OF SMOKER FEELS TOTALLY DEPENDENT"
2040 PRINT:2,"UPON HIS CIGARETTES, AND ALTERNATES BETWEEN AN"
2050 PRINT:2,"INCREASE OF POSITIVE AND A DECREASE OF NEGATIVE"
2060 PRINT:2,"FEELINGS.  HE IS CONSTANTLY AWARE WHEN HE IS NOT"
2070 PRINT:2,"SMOKING AND BEGINS THE CRAVING FOR THE NEXT"
2080 PRINT:2,"CIGARETTE WHEN HE PUTS OUT THE PRESENT ONE."
2090 PRINT:2,"TAPERING OFF DOESN'T SEEM TO WORK; THE ONLY"
2100 PRINT:2,"SOLUTION IS TO QUIT `COLD TURKEY'."
2110 PRINT:2," "
2120 IF H2<7.5 THEN 2180
2130 IF H2<10.5 THEN 2160
2140 PRINT:2,"HABIT IS AN IMPORTANT SOURCE OF"
2150 GOTO 2170
2160 PRINT:2,"HABIT IS A MARGINAL SOURCE OF"
2170 PRINT:2,"SATISFACTION FOR YOU."\GOTO 2210
2180 PRINT:2,"SINCE HABIT IS NOT AN IMPORTANT FACTOR TO"
2190 PRINT:2,"YOU, THE FOLLOWING PARAGRAPH PROBABLY DOESN'T"
2200 PRINT:2,"APPLY TO YOU."
2210 PRINT:2,"HABIT (10%)."
2220 PRINT:2,"THE HABITUAL SMOKER GETS VERY LITTLE",
2230 PRINT:2," SATISFACTION"
2240 PRINT:2,"FROM HIS HABIT AND PERFORMS IT SOMEWHAT"
2250 PRINT:2,"AUTOMATICALLY.  HE MAY SMOKE A CIGARETTE WITHOUT"
2260 PRINT:2,"REALIZING IT OR EVEN WANTING IT.  THERE IS VERY"
2270 PRINT:2,"LITTLE EMOTIONAL COMPONENT TO HIS SMOKING"
2280 PRINT:2,"ACTIVITY AND A  MINIMAL AMOUNT OF AWARENESS."
2290 PRINT:2,"IT IS IMPORTANT FOR HIM TO DEVELOP THIS"
2300 PRINT:2,"AWARENESS AND TO UNDERSTAND THE PATTERN OF HIS"
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CIRCLE 288 ON READER SERVICE CARD

Smokers Test, continued...

```
2310 PRINT:2,'SMOKING.'
2320 PRINT:2,'  '
2330 PRINT:2,'CIGARETTE SMOKING CAN BE VIEWED MAINLY AS A'
2340 PRINT:2,'PSYCHOLOGICAL HABIT WITH ACCOMPANYING'
2350 PRINT:2,'PHARMACOLOGICAL AND SOCIAL SATISFACTIONS AND'
2360 PRINT:2,'REINFORCEMENTS.  IT IS MAINLY A LEARNED BEHAVIOR'
2370 PRINT:2,'OCCURRING IN RESPONSE TO DIRECT AND INDIRECT'
2380 PRINT:2,'SOCIAL PRESSURES.  THOUGH EACH PERSON'S SMOKING'
2390 PRINT:2,'HABIT IS INDIVIDUALIZED, STUDIES SHOW THAT'
2400 PRINT:2,'SMOKERS FIND AT LEAST SIX PSYCHOLOGICAL'
2410 PRINT:2,'SATISFACTIONS IN THE HABIT: 1. STIMULATION'
2420 PRINT:2,'2. HANDLING  3. RELAXATION 4. TENSION REDUCTION'
2430 PRINT:2,'5. CRAVING 6. HABIT'
2440 PRINT:2,' '
2450 PRINT:2,'TO QUIT SMOKING THE INDIVIDUAL MUST UNDERGO'
2460 PRINT:2,'PHYSICAL AND PSYCHOLOGICAL WITHDRAWAL.  PHYSICAL'
2470 PRINT:2,'WITHDRAWAL SYMPTOMS LAST ABOUT ONE WEEK BUT IT'
2480 PRINT:2,'MAY TAKE MONTHS OR YEARS TO RESTRUCTURE A LIFE'
2490 PRINT:2,'WITHOUT CIGARETTES.  QUITTING IS A LONG-TERM'
2500 PRINT:2,'LEARNING PROCESS INVOLVING A GREAT DEAL OF'
2510 PRINT:2,'UNCONSCIOUS, CONSTRUCTIVE AND PAINFUL CONFLICT.'
2520 PRINT:2,'ONE CAN STOP SMOKING IF THE PATIENT WISHES TO'
2530 PRINT:2,'DO SO, ATTACKS THE PROBLEM ON A BROAD FRONT,'
2540 PRINT:2,'DOESN'T LOOK BACK, AND IF SUITABLE SATISFYING'
2550 PRINT:2,'ALTERNATIVES AND INVOLVEMENTS ARE DISCOVERED.'
2560 PRINT:2,CHR$(12)
2570 REM  END  OF PROGRAM
2580 STOP
2590 PRINT 'YOU ENTERED DATA IN ERROR!'
2600 RESET(ERR)\GOTO 2670
2610 REM END OF ERROR ROUTINE
2620 STOP
2630 REM Answer Routine
2640 PRINT CHR$(12)
2650 PRINT 'ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1'
2660 RETURN
2670 INPUT ' ?',Z1
2680 IF Z1>=1 AND Z1<=5 AND Z1=INT(Z1) THEN RETURN
2690 PRINT 'Answer NOT valid!!!'\GOTO 2670
```

```
A
   270     830

B
   300     830

C1
   840     970     980    1070    1730    1740

C2
   850     990    1000    1090    1930    1940

C
   330     840

D
   360     840

E
   400     850

F
   430     850

G
   460     830

H1
   830     940    1050    1350

H2
   850    1010    1100    2120    2130

H
   500     830

I
   520     840

J
   550     840

K
   580     850

L
   610     850

M
   640     830

N
   680     830

O
   710     840

P1
   840     950     960    1060    1510    1520

P
   750     840

Q
   790     850

R
   820     850    1030

S
   830     930    1040    1180    1190

Z1
   270     300     330     360     400     430     460     500     520
   550     580     610     640     680     710     750     790     820
  2670    2680
```

```
                    WHY DO YOU SMOKE?
HERE ARE SOME STATEMENTS MADE BY PEOPLE TO
DESCRIBE WHAT THEY GET OUT OF SMOKING CIGARETTES.
HOW OFTEN DO YOU FEEL THIS WAY WHEN YOU SMOKING THEM?
TO ANSWER THE UPCOMING QUESTIONS, USE THE FOLLOWING
NUMBERS. ALWAYS=5  FREQUENTLY=4  OCCASIONALLY=3
SELDOM=2 NEVER=1   (THEN HIT RETURN).
(Note!The Above will  appear  on every question)
(IMPORTANT PLEASE ANSWER EVERY QUESTION).
(TYPE ANY 'LETTER' TO CONTINUE)Waiting...
```

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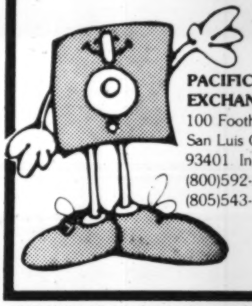

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CIRCLE 142 ON READER SERVICE CARD

Smokers Test, continued...

```
ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
I SMOKE CIGARETTES IN ORDER TO KEEP MYSELF FROM
SLOWING DOWN ?2


ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
HANDLING A CIGARETTE IS PART OF THE ENJOYMENT
OF SMOKING IT ?1↑
YOU ENTERED DATA IN ERROR!
 ?1
SMOKING CIGARETTES IS PLEASANT AND RELAXING  ?4


ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
I LIGHT UP A CIGARETTE WHEN I FEEL ANGRY
ABOUT SOMETHING ?2


ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
WHEN I HAVE RUN OUT OF CIGARETTES I FIND IT
ALMOST UNBEARABLE UNTIL I CAN GET THEM ?5


ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
I SMOKE CIGARETTES AUTOMATICALLY WITHOUT
EVEN BEING AWARE OF IT ?3


ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
I SMOKE CIGARETTES TO STIMULATE ME, TO PERK
MYSELF UP ?5


ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
PART OF THE ENJOYMENT OF SMOKING A CIGARETTE
COMES FROM THE STEPS I TAKE TO LIGHT UP ?4


ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
I FIND CIGARETTES PLEASURABLE ?5


ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
WHEN I FEEL UNCOMFORTABLE OR UPSET ABOUT
SOMETHING I LIGHT UP A CIGARETTE ?4


ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
I AM VERY MUCH AWARE OF THE FACT WHEN I AM NOT
SMOKING A CIGARETTE ?3


ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
I LIGHT UP A CIGARETTE WITHOUT REALIZING I STILL
HAVE ONE BURNING IN THE ASHTRAY ?4


ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
I SMOKE CIGARETTES TO GIVE ME A 'LIFT' ?4


ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
WHEN I SMOKE A CIGARETTE, PART OF THE ENJOYMENT
IS WATCHING THE SMOKE AS I EXHALE IT ?1


ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
I WANT A CIGARETTE MOST WHEN I AM COMFORTABLE
AND RELAXED ?5
```

```
ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
WHEN I FEEL 'BLUE' OR WANT TO TAKE MY MIND OFF
CARES AND WORRIES, I SMOKE CIGARETTES ?4


ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
I GET A REAL GNAWING HUNGER FOR A CIGARETTE
WHEN I HAVEN'T SMOKED FOR A WHILE ?5


ALWAYS=5, FREQ=4, OCCAS=3, SELDOM=2, NEV=1
I'VE FOUND A CIGARETTE IN MY MOUTH AND DIDN'T
REMEMBER PUTTING IT THERE ?3


SCORES OF 11 OR ABOVE INDICATE THAT THIS FACTOR IS
AN IMPORTANT SOURCE OF SATISFACTION FOR THE SMOKER.
SCORES OF 7 OR LESS ARE LOW AND PROBABLY INDICATE
THAT THIS FACTOR DOES NOT APPLY TO YOU.
SCORES IN BETWEEN ARE MARGINAL.

YOUR STIMULATION SCORE IS  11
YOUR PLEASURABLE RELAXATION SCORE IS  14
YOUR CRAVING: PSYCHOLOGICAL ADDICTION SCORE IS  13
YOUR STIMULATION SCORE IS  11
YOUR HANDLING SCORE IS  6
YOUR PLEASURE RELAXATION SCORE IS  14
YOUR CRUTCH: TENSION REDUCTION SCORE IS  10
YOUR CRAVING: PSYCHOLOGICAL ADDICTION SCORE IS  13
YOUR HABIT SCORE IS  10

SCORES OF 11 OR ABOVE INDICATE THAT THIS FACTOR
IS AN IMPORTANT SOURCE OF SATISFACTION FOR YOU
THE SMOKER.SCORES BETWEEN 7 AND 11 ARE MARGINAL
SCORES OF 7 OR LESS INDICATE THAT THESE FACTORS
PROBABLY DO NOT APPLY TO YOU.

STIMULATION IS AN IMPORTANT SOURCE OF
SATISFACTION FOR YOU.
STIMULATION (10% OF SMOKERS) THIS TYPE OF SMOKER
IS STIMULATED BY THE CIGARETTE.  IT HELPS HIM TO
WAKE UP IN THE MORNING, TO ORGANIZE HIS ENERGIES
AND TO KEEP HIM GOING.  MANY SMOKERS  REPORT
THAT WHILE SMOKING THEY EXPERIENCE A SHARPENING
OF INTELECTUAL CAPACITY AND AN INCREASE IN
IMPULSE CONTROL.

SINCE HANDLING IS NOT AN IMPORTANT FACTOR TO
YOU, THE FOLLOWING PARAGRAPH PROBABLY DOESN'T
APPLY TO YOU.
HANDLING: SENSORIMOTOR MANIPULATION (10%)
THIS TYPE ENJOYS MANIPULATING THE CIGARETTE
WITH HIS HANDS, WATCHING THE SMOKE CURL AS HE
EXHALES, AND MAKING A PRODUCTION OF LIGHTING
THE CIGARETTE, HOLDING IT, AND FLICKING THE
ASHES.

PLEASUREABLE RELAXATION IS AN IMPORTANT SOURCE
OF SATISFACTION FOR YOU.
PLEASUREABLE RELAXATION (15%).
THIS SMOKER GETS REAL, HONEST  PLEASURE FROM
SMOKING, ESPECIALLY AFTER A DINNER OR WITH A
COCKTAIL.  HE TENDS TO SMOKE TO ACCENTUATE OR
ENHANCE PLEASURABLE FEELINGS ACCOMPANYING A
STATE OF WELL BEING.

THE ABOVE SMOKERS CHARACTERISTICALLY SMOKE
UNDER PLEASANT CIRCUMSTANCES THAT ARE RELAXING.
```

```
THEY USUALLY REQUIRE AN ADEQUATE SUBSTITUTE FOR
QUITTING AND OFTEN FIND THAT IT IS NOT TOO
DIFFICULT TO STOP.

CRUTCH: TENSION REDUCTION IS A MARGINAL SOURCE
OF SATISFACTION FOR YOU.
CRUTCH: TENSION REDUCTION (30%).
THIS NEGATIVE-AFFECT TYPE OF SMOKER USES
CIGARETTES FOR THE SEDATIVE OR TRANQUILIZER
EFFECT IN MOMENTS OF STRESS, FEAR, SHAME,
DISGUST, DISCOMFORT, OR PRESSURE.  HE USES
CIGARETTES TO HELP HIM COPE WITH PROBLEMS.
SUBSTITUTIONS WILL GENERALLY NOT HELP THIS
SMOKER, AND SUCCESS IS GAINED FROM LEARNING
HOW TO PROPERLY MANAGE THE SITUATIONS THAT
PRODUCE THE BAD FEELINGS IN THE FIRST PLACE.

CRAVING: PSYCHOLOGICAL ADDICTION IS AN IMPORTANT
SOURCE OF SATISFACTION FOR YOU.
CRAVING: PSYCHOLOGICAL ADDICTION (25%).
THIS TYPE OF SMOKER FEELS TOTALLY DEPENDENT
UPON HIS CIGARETTES, AND ALTERNATES BETWEEN AN
INCREASE OF POSITIVE AND A DECREASE OF NEGATIVE
FEELINGS.  HE IS CONSTANTLY AWARE WHEN HE IS NOT
SMOKING AND BEGINS THE CRAVING FOR THE NEXT
CIGARETTE WHEN HE PUTS OUT THE PRESENT ONE.
TAPERING OFF DOESN'T SEEM TO WORK! THE ONLY
SOLUTION IS TO QUIT 'COLD TURKEY'.

HABIT IS A MARGINAL SOURCE OF
SATISFACTION FOR YOU.
HABIT (10%).
THE HABITUAL SMOKER GETS VERY LITTLE SATISFACTION
FROM HIS HABIT AND PERFORMS IT SOMEWHAT
AUTOMATICALLY.  HE MAY SMOKE A CIGARETTE WITHOUT
REALIZING IT OR EVEN WANTING IT.  THERE IS VERY
LITTLE EMOTIONAL COMPONENT TO HIS SMOKING
ACTIVITY AND A  MINIMAL AMOUNT OF AWARENESS.
IT IS IMPORTANT FOR HIM TO DEVELOP THIS
AWARENESS AND TO UNDERSTAND THE PATTERN OF HIS
SMOKING.

CIGARETTE SMOKING CAN BE VIEWED MAINLY AS A
PSYCHOLOGICAL HABIT WITH ACCOMPANYING
PHARMACOLOGICAL AND SOCIAL SATISFACTIONS AND
REINFORCEMENTS.  IT IS MAINLY A LEARNED BEHAVIOR
OCCURRING IN RESPONSE TO DIRECT AND INDIRECT
SOCIAL PRESSURES.  THOUGH EACH PERSON'S SMOKING
HABIT IS INDIVIDUALIZED, STUDIES SHOW THAT
SMOKERS FIND AT LEAST SIX PSYCHOLOGICAL
SATISFACTIONS IN THE HABIT: 1. STIMULATION
2. HANDLING  3. RELAXATION 4. TENSION REDUCTION
5. CRAVING 6. HABIT

TO QUIT SMOKING THE INDIVIDUAL MUST UNDERGO
PHYSICAL AND PSYCHOLOGICAL WITHDRAWAL.  PHYSICAL
WITHDRAWAL SYMPTOMS LAST ABOUT ONE WEEK BUT IT
MAY TAKE MONTHS OR YEARS TO RESTRUCTURE A LIFE
WITHOUT CIGARETTES.  QUITTING IS A LONG-TERM
LEARNING PROCESS INVOLVING A GREAT DEAL OF
UNCONSCIOUS, CONSTRUCTIVE AND PAINFUL CONFLICT.
ONE CAN STOP SMOKING IF THE PATIENT WISHES TO
DO SO, ATTACKS THE PROBLEM ON A BROAD FRONT,
DOESN'T LOOK BACK, AND IF SUITABLE SATISFYING
ALTERNATIVES AND INVOLVEMENTS ARE DISCOVERED.

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Chess C.4

Michael Rakaska

While no challenge to Bobby Fischer, this program is worth presenting for several reasons. We feel that it gives good insight into one approach to computer chess strategy. It also provides a base for developing a stronger and faster program. You can experiment with different weighting factors, add book openings, try different strategies or just have fun with the program—D.L.

There is a scarcity of good computer chess programs written in the Basic language. In Chess C.4 I have striven for good speed of execution, playing ability, ease of use, variety of options available during play, and clarity of the evaluation of move generation and routines.

The program is compact. In a 16K machine 2.6K is left free. (If the instructions are eliminated 5.5K is free.)

This is also a rather fast program, considering its level of play and the fact that it is in Basic. Try a fool's mate on this one and you may lose your pants.

In addition to normal play, the user may at any time exchange sides with the computer, set the computer to self-play mode (automatically plays white vs black—watch the computer play by itself! Bet on sides!), change the level of play (1 to 24), modify the board any way desired (put on an extra queen, remove any piece).

The computer will concede if it has been stalemated.

I am rather proud of the board and pieces, graphically speaking. The squares are solid white and solid black, as are the pieces. When a piece moves into a square of its own color, it is silhouetted slightly with the opposite color. The king is the tallest piece and all the pieces look like chess pieces. No guesswork is required to figure out which piece is which and who it belongs to, even in an advanced middle game.

To use the program, simply CLOAD, type RUN, answer the prompt for instructions, and reply to questions on your name, level of play, and choice of colors. From then on just follow the messages and prompts in the upper right of the screen. The computer will flash a $ in the upper right while it is considering moves.

To move a piece simply specify the "from" and "to" squares in algebraic notation, e.g., E2E4. Only four keystrokes are required. If an "illegal move" or "entry error" message appears, just re-enter the move.

Special Commands

There are several special commands. They are simple to remember and require

They are simple to remember and require

only one keystroke. Here is an abbreviated list:

X *Exchange sides*: The pieces the computer is going to move will always be at the top of the screen so the player sees the board as if he were viewing it from his own side.

S *Self-playing mode*: The computer will play against itself continuously with no further player intervention required.

I *Instruction request.*

N *Number the board*: During regular play the numbers are removed after a move is made. This also works during "modify" mode.

L *Level of play*: Current level is displayed with a prompt, "change levels?" Player should answer Y (yes) and the displayed level will go blank. Then enter a one-digit number and hit the ENTER-key, or a two-digit number (e.g. 01, 24, etc.) in which case ENTER is not needed. The computer is looking for a two-digit number, so that is why ENTER or any other nonnumeric key must be used with a single-digit number. If the reply originally was N (no), then regular play will continue.

M *Modify the board:* In this mode, four keystrokes are required for each modification of a square. Specify the "from" square and "type of piece." The type of piece is two characters. The first character is a C, P, or E for computer, player, or empty respectively. The second character is a P, N, B, R, Q, K, or S for pawn, knight, bishop, rook, queen, king, and square respectively. For example, CQ = Computer Queen, PR = Player Rook, and ES = Empty Square. Pieces are taken off the

---

Michael C. Rakaska, 5th FASC, Stop #13, Cherry Point, NC 28533.

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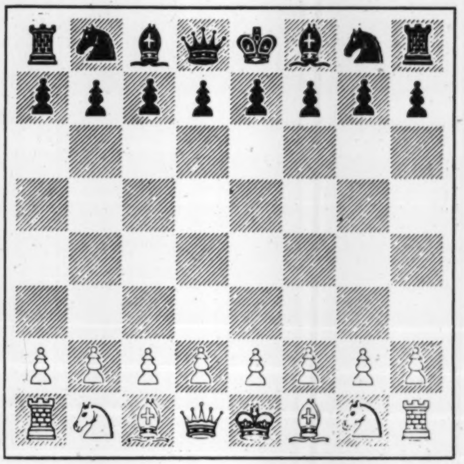
```
10 REM CHESS C.4 BY M.C. RAKASKA, IDES OF MARCH, 1980
20 DEFINTA-Z:A=0:B=0:X=0:Y=0:S=0:A0=0:T=0:A8=0:A1=0:A2=0:A3=0:A4=0:B1=0:B6!=0:H=0:M=0:N=0:P=0:W=0:A5=0:I=1:DIMC(64)
30 CLS:PRINTCHR$(23):INPUT"DO YOU WANT INSTRUCTIONS ";IN$:IN$=LEFT$(IN$,1):IFIN$="Y"THENGOSUB2220
40 CL$="N"
50 CLS:PRINTCHR$(23):INPUT"YOUR NAME IS ";B$:IFB$=""THEN B$=" HUMAN  "ELSEB$=LEFT$(B$,9)
60 CLS:PRINTCHR$(23):PRINT"LEVEL OF PLAY";:INPUTB8!:IFB8!=0THENB8!=1:B7!=1+RND(0)/2:ELSEB7!=(B8!+1)/2+RND(0)/2
70 CLS:PRINTCHR$(23):PRINT"DO YOU WANT WHITE ";B$;" ";:INPUTC$:GOSUB790:IFLEFT$(C$,1)<>"N"THENGOSUB900:GOTO190
80 GOSUB890:IFCL$="Y"THENPRINT@306,"START ";RIGHT$(TIME$,8);:PRINT@370,STRING$(15,CHR$(128));
100 F!=-99:A0=0:FORJ=1TO8:FORK=1TO8:IFA(J,K)=99THENA6=J:A7=K
110 NEXT:NEXT
120 FORX=1TO8:FORY=1TO8:IFA(X,Y)<0THENGOSUB270:IFF!>=B7!THENGOTO150
130 NEXT:NEXT:IFF!>=-9THENGOTO150ELSEGOSUB900
140 PRINT@242,"I CONCEDE    ";:GOTO2190
150 A(R,U)=A(E,Q):A(E,Q)=1:IFA(R,U)=-2ANDU=1THENA(R,U)=-9
160 X=R:Y=U:A0=4:GOSUB270:PRINT@242,"IS MY MOVE    ";:PRINT@178,CHR$(E+64);Q;"- "CHR$(R+64);U;
170 IFCL$="Y"THENPRINT@370,"STOP ";RIGHT$(TIME$,8);
180 X=E:Y=Q:GOSUB910:X=R:Y=U:GOSUB910:IFC=1THENPRINT@242,"CHECK ";B$;:C=0
190 IFX$="S"THENGOSUB1830:B7!=3*RND(0):PRINT@50,"SELF-PLAYING";:GOSUB2480:GOTO100:ELSEPRINT@114,"MOVE ";B$;:GOSUB1590:D=0:B4=A:B9=B:
B5=0:IFA(X,Y)=2ANDY=5ANDB=6ANDA(A,B)=1ANDABS(A-X)=1THENB5=1:GOTO220
200 IFX$="K"ORX$="Q"THENGOSUB900:PRINT@114,STRING$(14," ");:GOTO100
210 IFX$="S"THENCL$="N":GOTO190ELSEA0=3:GOSUB250:IFD=0THENPRINT@242,"ILLEGAL        ";:GOTO190
220 PRINT@114,"OK              ";:A=B4:B=B9:A(A,B)=A(X,Y):A(X,Y)=1:GOSUB910:X=A:Y=B:GOSUB910:IFN$="N"THENGOSUB900:N$=" "
230 IFA(A,B)=2ANDB=8THENPRINT@114,"WHAT PIECE";:GOSUB 2100:X=A:Y=B:GOSUB910:PRINT@114,STRING$(14," ");:PRINT@178,STRING$(14," ");
240 IFB5=1THENA(A,B-1)=1:X=A:Y=B-1:GOSUB910:GOTO100:ELSEGOTO100
250 PRINT@62,"$ ";:ONA(X,Y)GOTO0,480,0,380,330,0,280,0,330:GOTO460
270 ON-A(X,Y)GOTO0,530,0,380,330,0,280,0,330:GOTO460
280 B=Y:FORA=X+1TO8:GOSUB640:IFS=0THENNEXTELSEGOTO290
290 FORA=X-1TO1STEP-1:GOSUB640:IFS=0THENNEXTELSEGOTO300
300 A=X:FORB=Y+1TO8:GOSUB640:IFS=0THENNEXTELSEGOTO310
310 FORB=Y-1TO1STEP-1:GOSUB640:IFS=0THENNEXT:RETURNELSERETURN
330 B=Y:FORA=X+1TO8:B=B+1:GOSUB640:IFS=0THENNEXTELSEGOTO340
340 B=Y:FORA=X-1TO1STEP-1:B=B-1:GOSUB640:IFS=0THENNEXTELSEGOTO350
350 B=Y:FORA=X-1TO1STEP-1:B=B+1:GOSUB640:IFS=0THENNEXTELSEGOTO360
360 B=Y:FORA=X+1TO8:B=B-1:GOSUB640:IFS=0THENNEXTELSEGOTO370
370 IFABS(A(X,Y))=9THENGOTO280:ELSERETURN
380 A=X+2:B=Y+1:IFA<9ANDB<9THENGOSUB650ELSEGOTO390
390 B=B-2:IFB>0ANDA<9THENGOSUB650ELSEGOTO400
400 A=A-4:IFA>0ANDB>0THENGOSUB650ELSEGOTO410
410 B=B+2:IFB<9ANDA>0THENGOSUB650ELSEGOTO420
420 A=A+1:B=B+1:IFA>0ANDA<9ANDB<9THENGOSUB650ELSEGOTO430
430 B=B-4:IFB>0ANDA>0ANDA<9GOSUB650ELSEGOTO440
440 A=A+2:IFA>0ANDA<9ANDB>0GOSUB650ELSEGOTO450
450 B=B+4:IFB<9ANDA>0ANDA<9GOSUB650:RETURN:ELSERETURN
460 FORA=X-1TOX+1:FORB=Y-1TOY+1:IFA(A,B)<>0THENGOSUB650
470 NEXT:NEXT:RETURN
```



```
480 A=X:IFY>2THENGOTO500ELSEGOTO490
490 B=Y+1:IFA(A,B)=1THENGOSUB660:B=B+1:IFA(A,B)=1THENGOSUB660:GOTO510:ELSEGOTO510:ELSEGOTO510
500 B=Y+1:IFA(A,B)=1THENGOSUB660ELSEGOTO510
510 A=X+1:B=Y+1:IFA(A,B)<0THENGOSUB660ELSEGOTO520
520 A=A-2:IFA(A,B)<0THENGOSUB660:RETURN:ELSERETURN
530 A=X:IFY<7THENGOTO550ELSEGOTO540
540 B=Y-1:IFA(A,B)=1THENGOSUB660:B=B-1:IFA(A,B)=1THENGOSUB660:GOTO560:ELSEGOTO560:ELSEGOTO560
550 B=Y-1:IFA(A,B)=1THENGOSUB660ELSEGOTO560
560 A=X-1:B=Y-1:IFA(A,B)>1THENGOSUB660ELSEGOTO570
570 A=A+2:IFA(A,B)>1THENGOSUB660:RETURN:ELSERETURN
580 T=A(A,B):IFT=-99THENB1=T:RETURN:ELSEGOTO590
590 A5=S:IFABS(T)<=A(X,Y)THENA(A,B)=A(X,Y):A(X,Y)=1:GOTO610:ELSEGOTO600
600 IFT<B1THENB1=T:S=A5:RETURN:ELSES=A5:RETURN
610 A1=X:A2=Y:A3=A:A4=B:A8=T:A0=2:FORX=1TO8:FORY=1TO8:IFA(X,Y)<0THENGOSUB270:IFT=0THENGOTO630
620 NEXT:NEXT
630 X=A1:Y=A2:A=A3:B=A4:A0=5:A(X,Y)=A(A,B):A(A,B)=A8:GOTO600
640 S=0:IFA(A,B)=1THENGOTO660ELSEIFA(A,B)=0THENS=1:RETURN:ELSEIFSGN(A(A,B))=SGN(A(X,Y))THENS=1:RETURN:ELSES=1:GOTO660
650 IFA(A,B)=1THENGOTO660ELSEIFSGN(A(A,B))=SGN(A(X,Y))THENRETURN:ELSEGOTO660
```

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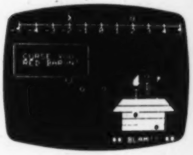

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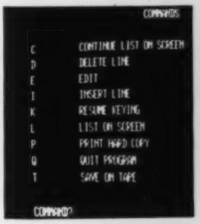

```
                    COMMANDS

C       CONTINUE LIST ON SCREEN
D       DELETE LINE
E       EDIT
I       INSERT LINE
K       RESUME KEYING
L       LIST ON SCREEN
P       PRINT HARD COPY
Q       QUIT PROGRAM
T       SAVE ON TAPE

  COMMAND?
```

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board or put on individually. To move a computer rook from A1 to B3 type A1ES to empty the square and B3CR to put Computer Rook on B3. Any piece can be put on any square even if it is already occupied.

Z *Escape modify mode*: The computer will make its move when you have finished making all of your modifications.

K *King-side castle*.

Q *Queen-side castle*.

Description of the Program

The computer generates a single legal move for one of its pieces and then calculates all expected player responses. If a computer piece is under attack it searches for one of its pieces to protect the attacked piece (unless the attacked piece is the king). The computer repeats the procedure for every possible move of each one of its pieces until it finds a "move value" (represented by G!) that is equal to or greater than the adjusted level of play (B7!). At this time it actually makes the move. A move is from A(x,y) to A(a,b) where x,y,a,b are in the range one to eight.

The "move value" is determined in line 760 as

G! = P + B1 + B6!

Where P is the piece the computer may take (capture), B1 is the piece the player may capture (negative value) to which one is added if the computer can put the player in check as a result of this loss; and B6! is a value based on three factors:

control of center: 1/ABS(4.5-A)+ABS (4.5-B)

attack on player's king: 1/ABS(A6-A) +ABS(A7-B)+5

movement of a minor piece: RND(0)/15 (A minor piece is a knight, bishop, or rook.) These three factors are the key to good moves and the aggressive or defensive nature of play of each type of piece.

The internal representation of the chess board is in array A(x,y) where x,y are from one to eight. A(1,1) is in the lower left of the screen and A(8,8) is in the upper right. The input/output is edited to produce algebraic notation. The values of the pieces are read in lines 820-860. All squares have a sign in S(x,y), +1 for white and -1 for black. The computer's pieces are negative and the player's pieces are positive. An empty square has a value of one.

```
660 PRINT@62,"  ";:ONA0GOTO670,680,690,700,710:GOTO720
670 IFA6=AANDA7=BTHENB1=B1+1:RETURN:ELSERETURN
680 IFA3=AANDA4=BTHENT=0:RETURN:ELSERETURN
690 IFB4=AANDB9=BTHEND=1:RETURN:ELSERETURN
700 IFA6=AANDA7=BTHENC=1:RETURN:ELSERETURN
710 IFA(A,B)<0THENGOTO580ELSERETURN
720 B3=S:W=X:M=Y:N=A:H=B:P=A(A,B):A(A,B)=A(X,Y):A(X,Y)=1:B1=0
730 A0=5:FORX=1TO8:FORY=1TO8:IFA(X,Y)>1THENGOSUB250
740 NEXT:NEXT:X=N:Y=H:A0=1:GOSUB270:A0=0:S=B3:X=W:Y=M:A=N:B=H:A(X,Y)=A(A,B):A(A,B)=P
750 B6!=1/(ABS(4.5-A)+ABS(4.5-B)+1)
       :IFA(X,Y)<-2ANDA(X,Y)>-9THENB6!=B6!+1/(ABS(A6-A)+ABS(A7-B)+5)+RND(0)/15
760 G!=P+B1+B6!:IFP=99THENGOSUB900:PRINT@242,"MATE ";B$;:GOTO2190
770 IFG!<=F!THENRETURN
780 F!=G!:E=X:Q=Y:R=A:U=B:RETURN
790 CLS
800 Y=0:FORJ=896TO0STEP-128:Y=Y+1:X=0:FORK=JTO42+JSTEP6:X=X+1:T(X,Y)=K:NEXT:NEXT
810 Y=0:FORJ=960TO64STEP-128:Y=Y+1:X=0:FORK=JTO42+JSTEP6:X=X+1:B(X,Y)=K:NEXT:NEXT
820 DATA-7,-4,-5,-9,-99,-5,-4,-7
830 DATA-2,-2,-2,-2,-2,-2,-2,-2
840 DATA1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
850 DATA2,2,2,2,2,2,2,2
860 DATA7,4,5,9,99,5,4,7
870 FORY=8TO1STEP-1:FORX=1TO7STEP2:S(X,Y)=I:S(X+1,Y)=-I:NEXT:I=-I:NEXT
880 FORY=8TO1STEP-1:FORX=1TO8:READA(X,Y):NEXT:NEXT:RETURN
890 I=-I:A(4,1)=99:A(5,1)=9:A(4,8)=-99:A(5,8)=-9
900 FORY=1TO8:FORX=1TO8:GOSUB910:NEXT:NEXT:RETURN
910 IFS(X,Y)>0THENGOTO940
920 ONABS(A(X,Y))GOSUB980,1040,0,1340,1440,0,1540,0,1140
          :IFABS(A(X,Y))=99THENGOSUB1240:RETURNELSERETURN
940 ONABS(A(X,Y))GOSUB960,990,0,1290,1390,0,1490,0,1090
          :IFABS(A(X,Y))=99THENGOSUB1190:RETURNELSERETURN
960 IFS(X,Y)<0THENGOTO980
970 PRINT@T(X,Y),STRING$(6,CHR$(191));:PRINT@B(X,Y),STRING$(6,CHR$(191));:RETURN
980 PRINT@T(X,Y),STRING$(6," ");:PRINT@B(X,Y),STRING$(6," ");:RETURN
990 IFI*A(X,Y)<0GOTO1020
1000 PRINT@T(X,Y),CHR$(191);CHR$(191);CHR$(191);CHR$(191);CHR$(191);CHR$(191);
1010 PRINT@B(X,Y),CHR$(191);CHR$(173);CHR$(187);CHR$(185);CHR$(175);CHR$(191);:RETURN
1020 PRINT@T(X,Y),STRING$(6,CHR$(191));
1030 PRINT@B(X,Y),CHR$(191);CHR$(159);CHR$(132);CHR$(142);CHR$(191);CHR$(191);:RETURN
1040 IFI*A(X,Y)<0GOTO1070
1050 PRINT@T(X,Y),STRING$(6,CHR$(128));
1060 PRINT@B(X,Y),CHR$(128);CHR$(160);CHR$(187);CHR$(177);CHR$(128);CHR$(128);:RETURN
1070 PRINT@T(X,Y),STRING$(6,CHR$(128));
1080 PRINT@B(X,Y),CHR$(128);CHR$(146);CHR$(132);CHR$(134);CHR$(144);CHR$(128);:RETURN
1090 IFI*A(X,Y)<0GOTO1120
1100 PRINT@T(X,Y),CHR$(191);CHR$(183);CHR$(175);CHR$(167);CHR$(191);CHR$(191);
1110 PRINT@B(X,Y),CHR$(191);CHR$(173);CHR$(187);CHR$(185);CHR$(175);CHR$(191);:RETURN
1120 PRINT@T(X,Y),CHR$(191);CHR$(191);CHR$(147);CHR$(187);CHR$(191);CHR$(191);
1130 PRINT@B(X,Y),CHR$(191);CHR$(159);CHR$(132);CHR$(142);CHR$(191);CHR$(191);:RETURN
1140 IFI*A(X,Y)<0GOTO1170
1150 PRINT@T(X,Y),CHR$(128);CHR$(128);CHR$(172);CHR$(132);CHR$(128);CHR$(128);
1160 PRINT@B(X,Y),CHR$(128);CHR$(160);CHR$(187);CHR$(177);CHR$(128);CHR$(128);:RETURN
1170 PRINT@T(X,Y),CHR$(128);CHR$(136);CHR$(144);CHR$(152);CHR$(128);CHR$(128);
1180 PRINT@B(X,Y),CHR$(128);CHR$(146);CHR$(132);CHR$(134);CHR$(144);CHR$(128);:RETURN
1190 IFI*A(X,Y)<0GOTO1220
1200 PRINT@T(X,Y),CHR$(191);CHR$(191);CHR$(153);CHR$(157);CHR$(187);CHR$(191);
1210 PRINT@B(X,Y),CHR$(191);CHR$(159);CHR$(186);CHR$(191);CHR$(154);CHR$(191);:RETURN
1220 PRINT@T(X,Y),CHR$(191);CHR$(191);CHR$(183);CHR$(162);CHR$(191);CHR$(191);
1230 PRINT@B(X,Y),CHR$(191);CHR$(191);CHR$(133);CHR$(128);CHR$(175);CHR$(191);:RETURN
1240 IFI*A(X,Y)<0GOTO1270
1250 PRINT@T(X,Y),CHR$(128);CHR$(128);CHR$(136);CHR$(157);CHR$(128);CHR$(128);
1260 PRINT@B(X,Y),CHR$(128);CHR$(128);CHR$(186);CHR$(191);CHR$(144);CHR$(128);:RETURN
1270 PRINT@T(X,Y),CHR$(128);CHR$(128);CHR$(166);CHR$(162);CHR$(132);CHR$(128);
1280 PRINT@B(X,Y),CHR$(128);CHR$(160);CHR$(133);CHR$(128);CHR$(165);CHR$(128);:RETURN
1290 IFI*A(X,Y)<0GOTO1320
1300 PRINT@T(X,Y),CHR$(191);CHR$(159);CHR$(179);CHR$(179);CHR$(175);CHR$(191);
```

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The major loop is from lines 100-240, where player input is fed to the computer and computer output is fed to the player. Lines 100 to 180 handle the computer's move and 190 to 240 handle the player's move. At 240, a loop back to 100 is made.

The computed GOSUBs at 250 and at 270 select the move generation for each type of piece. The player's pieces use 250 and the computer uses 270.

Lines 10-80 are initialization. The major subroutines are:

280-310 for rook moves
330-360 bishop
370 queen (uses the above two)
380-450 knight
460-470 king
480-520 player pawn
530-570 computer pawn
580-630 protect
640-650 legality
660-700 move generation usage
710-740 look ahead
750-780 evaluate
Lines 790-1580 are the graphics driver.
Other significant sections are:
1590-1720 player command
1730-1820 player input
1830 clears message area
1840-2020 modification
2030 number of the board
2040-2090 level of play
2100-2180 pawn promotion
2190-2210 end of game
2220-2460 instructions
2480-2520 exchange

Lines are numbered from 10 in increments of ten.

Lines 90, 260, 320, 930, 950, and 2470 are not used, nor are lines 2530-65520.

Line 65529 END is the last line of the program.

Variables

(Abbreviations in the variable descriptions are TV-temporary value, and TS-temporary storage.)

AO flag set =	
	0 if computer is moving 1 if king (players) is put in check 2 if in protect routine 3 to check player input 4 to see if player is still in check
A1-A4	TS of computer move
A5	TS of player's "safe move" flag in protect routine
A6-A7	location of player king
A8	TS of piece player may take
B1	see text for explanation of these
B6!	
B7!	
G!	
P	
B3	TS of computer "safe move" flag

```
1310 PRINT@B(X,Y),CHR$(191);CHR$(157);CHR$(185);CHR$(191);CHR$(154);CHR$(191);:RETURN
1320 PRINT@T(X,Y),CHR$(191);CHR$(191);CHR$(143);CHR$(143);CHR$(191);CHR$(191);
1330 PRINT@B(X,Y),CHR$(191);CHR$(191);CHR$(134);CHR$(128);CHR$(175);CHR$(191);:RETURN
1340 IFI*A(X,Y)<0GOTO1370
1350 PRINT@T(X,Y),CHR$(128);CHR$(128);CHR$(176);CHR$(176);CHR$(128);CHR$(128);
1360 PRINT@B(X,Y),CHR$(128);CHR$(128);CHR$(185);CHR$(191);CHR$(144);CHR$(128);:RETURN
1370 PRINT@T(X,Y),CHR$(128);CHR$(160);CHR$(140);CHR$(140);CHR$(144);CHR$(128);
1380 PRINT@B(X,Y),CHR$(128);CHR$(162);CHR$(134);CHR$(128);CHR$(165);CHR$(128);:RETURN
1390 IFI*A(X,Y)<0GOTO1420
1400 PRINT@T(X,Y),CHR$(191);CHR$(159);CHR$(187);CHR$(155),CHR$(191);CHR$(191);
1410 PRINT@B(X,Y),CHR$(191);CHR$(173);CHR$(187);CHR$(185);CHR$(175);CHR$(191);:RETURN
1420 PRINT@T(X,Y),CHR$(191);CHR$(191);CHR$(135);CHR$(175);CHR$(191);CHR$(191);
1430 PRINT@B(X,Y),CHR$(191);CHR$(159);CHR$(132);CHR$(142);CHR$(191);CHR$(191);:RETURN
1440 IFI*A(X,Y)<0GOTO1470
1450 PRINT@T(X,Y),CHR$(128);CHR$(128);CHR$(184);CHR$(144);CHR$(128);CHR$(128);
1460 PRINT@B(X,Y),CHR$(128);CHR$(160);CHR$(187);CHR$(177);CHR$(128);CHR$(128);:RETURN
1470 PRINT@T(X,Y),CHR$(128);CHR$(160);CHR$(132);CHR$(164);CHR$(128);CHR$(128);
1480 PRINT@B(X,Y),CHR$(128);CHR$(146);CHR$(132);CHR$(134);CHR$(144);CHR$(128);:RETURN
1490 IFI*A(X,Y)<0GOTO1520
1500 PRINT@T(X,Y),CHR$(191);CHR$(159);CHR$(159);CHR$(159);CHR$(159);CHR$(191);
1510 PRINT@B(X,Y),CHR$(191);CHR$(157);CHR$(187);CHR$(191);CHR$(153);CHR$(191);:RETURN
1520 PRINT@T(X,Y),CHR$(191);CHR$(191);CHR$(175);CHR$(175);CHR$(175);CHR$(191),
1530 PRINT@B(X,Y),CHR$(191);CHR$(191);CHR$(132);CHR$(128);CHR$(174);CHR$(191);:RETURN
1540 IFI*A(X,Y)>0GOTO1570
1550 PRINT@T(X,Y),CHR$(128);CHR$(160);CHR$(160);CHR$(160);CHR$(160);CHR$(128);
1560 PRINT@B(X,Y),CHR$(128);CHR$(162);CHR$(132);CHR$(128);CHR$(166);CHR$(128);:RETURN
1570 PRINT@T(X,Y),CHR$(128);CHR$(128);CHR$(144);CHR$(144);CHR$(144);CHR$(128);
1580 PRINT@B(X,Y),CHR$(128);CHR$(128);CHR$(187);CHR$(191);CHR$(145);CHR$(128);:RETURN
1590 PRINT@50,STRING$(14," ");:REMARK INPUT PLAYER MOVE
1600 X$=INKEY$:IFX$="N"THENN$=X$
1610 IFX$>="A"ANDX$<="H"THENX=VAL(CHR$(ASC(X$)-16)):GOTO1730
1620 IFX$="N"THENGOSUB2030
1630 IFX$="K"ANDA(5,1)=99ANDA(8,1)=7THENA(5,1)=1:A(8,1)=1:A(7,1)=99:A(6,1)=7:GOTO1800
1640 IFX$="Q"ANDA(5,1)=99ANDA(1,1)=7THENA(5,1)=1:A(1,1)=1:A(3,1)=99:A(4,1)=7:GOTO1800
1650 IFX$="K"ANDA(4,1)=99ANDA(1,1)=7THENA(4,1)=1:A(1,1)=1:A(2,1)=99:A(3,1)=7:GOTO1800
1660 IFX$="Q"ANDA(4,1)=99ANDA(8,1)=7THENA(4,1)=1:A(8,1)=1:A(6,1)=99:A(5,1)=7:GOTO1800
1670 IFX$="X"THENGOSUB1830:PRINT@50,"EXCHANGING   ";:GOSUB2480:
     :IFCL$="Y"THENPRINT@306,"START ";RIGHT$(TIME$,8);:GOTO100:ELSEGOTO100
1680 IFX$="S"THENGOTO1820
1690 IFX$="M"THENGOSUB1840
1700 IFX$="I"THENGOSUB2220:CLS:GOSUB900:PRINT@114,"MOVE ";B$;
1710 IFX$="L"THENGOSUB2040
1720 GOTO1600
1730 PRINT@51,X$;
1740 Y=VAL(INKEY$):IFY=0GOTO1740
1750 PRINT@52,Y;:PRINT@55,"-";
1760 IFA(X,Y)<2ORA(X,Y)>99THENPRINT@242,"ENTRY ERROR  ";:GOTO1590
1770 A$=INKEY$:IFA$<"A"ORA$>"H"THEN1770ELSEA=VAL(CHR$(ASC(A$)-16))
1780 PRINT@57,A$;
1790 B=VAL(INKEY$):IFB=0GOTO1790ELSEPRINT@58,B;
1800 IFX$="K"ORX$="Q"THENPRINT@50,"CSTL. ";X$;"-SIDE";:GOSUB1830ELSEGOSUB1830
1810 IFCL$="Y"THENPRINT@306,"START ";RIGHT$(TIME$,8);
1820 RETURN
1830 FORJ=114TO562STEP64:PRINT@J,STRING$(14," ");:NEXT:RETURN
1840 GOSUB1830:PRINT@50,"MODIFYING    ";
1850 GOSUB2010:IFM$<"A"ORM$>"H"THENGOTO1850
1860 X=VAL(CHR$(ASC(M$)-16)):PRINT@114,M$;
1870 M$=INKEY$:IFM$<"1"ORM$>"8"THENGOTO1870
1880 Y=VAL(M$):PRINT@116,M$;" = ";
1890 M$=INKEY$:IFM$="C"ORM$="P"ORM$="E"THENS1$=M$:PRINT@120,M$;ELSEGOTO1890
1900 M$=INKEY$:IFM$="S"ORM$="P"ORM$="N"ORM$="B"ORM$="R"ORM$="Q"ORM$="K"THENV$=M$
     :PRINT@122,M$;ELSEGOTO1900
1910 IFV$="P"THENV1=2
1920 IFV$="N"THENV1=4
1930 IFV$="B"THENV1=5
```

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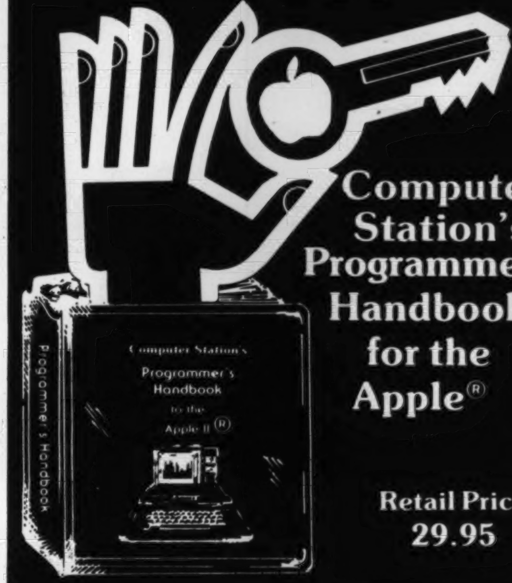

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Chess, continued...

B4,B9	TS of player "to" square move
B5	*en passant* flag
B8	level of play
D	player "input legal" flag
E,Q,R,U	selected computer move
F!	highest 'move value' so far
H,M,N,W	TS of computer move
S	"safe move" flag
T	piece player may take
V1	numeric value of promoted pawn

CL$ in line 40 is a computer move timer which can be turned on, if a time$ function is available, by setting CL$="Y."

Limitations

Castling and capturing *en passant* although used only by the player, are not checked by the computer in order to speed up play.

The player may promote pawns to any piece except the king, the computer always promotes to a queen.

Suggested Improvements

A table of standard openings could be used and the board positions compared against it; when a variation is found, a jump to lookahead would be made.

More incentives could be given to pawns to get to the last rank.

To make the computer generate more than three moves ahead the lookahead/protect/evaluate routines could be nested with similar one—but note that playing time more than doubles for each level. □

```
1940 IFV$="R"THENV1=7
1950 IFV$="Q"THENV1=9
1960 IFV$="K"THENV1=99
1970 IFV$="S"THENV1=1
1980 IFS1$="C"ANDV1<>1THENV1=-V1
1990 A(X,Y)=V1:IFS1$="E"THENA(X,Y)=1
2000 GOSUB910:GOTO1840
2010 M$=INKEY$:IFM$="N"THENGOSUB2030:GOTO2010:ELSEIFM$="Z"THENGOSUB1830
          :PRINT@50,STRING$(14," ");:GOSUB900:ELSERETURN
2020 IFCL$="Y"THENPRINT@306,"START ";RIGHT$(TIME$,8);:GOTO100ELSEGOTO100
2030 FORJ=1TO8:FORK=1TO8:K$=STR$(K):PRINT@B(J,K),CHR$(J+64);RIGHT$(K$,1);:NEXT:NEXT:RETURN
2040 GOSUB1830:PRINT@50,"LEVEL=";B8!;"   ";:PRINT@114,"CHANGE LEVELS?";
2050 C$=INKEY$:IFC$="N"THENGOTO2090ELSEIFC$="Y"THENPRINT@57,STRING$(7," ");
          :GOSUB1830:ELSEGOTO2050
2060 L1$=INKEY$:IFL1$=""THENGOTO2060ELSEIFL1$>="0"ANDL1$<="9"THENPRINT@57,L1$;:ELSEGOTO2060
2070 L2$=INKEY$:IFL2$=""THEN2070ELSEIFL2$<"0"ORL2$>"9"THENL2$=L1$:L1$="0"
2080 B8!=VAL(L1$)*10+VAL(L2$):B7!=B8!/2:PRINT@57,L1$;L2$;
2090 GOSUB1830:PRINT@50,STRING$(14," ");:PRINT@114,"MOVE ";B$;:RETURN
2100 REM *** PROMOTION ROUTINE
2110 PRINT@178,"P, N, B, R,~Q ";
2120 Z$=INKEY$:IFZ$="P"THENA(A,B)=2:GOTO2180
2130 IFZ$="N"THENA(A,B)=4:GOTO2180
2140 IFZ$="B"THENA(A,B)=5:GOTO2180

2150 IFZ$="R"THENA(A,B)=7:GOTO2180              2170 GOTO2120
2160 IFZ$="Q"THENA(A,B)=9:GOTO2180              2180 RETURN

2190 IFCL$="Y"THENPRINT@370,"STOP ";RIGHT$(TIME$,8);
2200 PRINT@560,"HIT 'P' TO PLAY";:PRINT@624,"OR 'B' FOR BASIC";
2210 A$=INKEY$:IFA$=""THENGOTO2210ELSEIFA$="B"THENCLS:ENDELSEIFA$="P"THENRUNELSEGOTO2210
2220 CLS:PRINT"1. USE LIST TO INSURE PGM LOADED RIGHT, THE LAST LINE IS 65529 "
2230 PRINT"2. ALSO NOTE MEMORY SIZE AS A DOUBLE CHECK "
2240 PRINT"3. SPECIAL COMMANDS DURING PLAYER'S MOVE ARE:"
2250 PRINT"   TYPE 'N' - TO NUMBER THE BOARD "
2260 PRINT"        'K' - TO CASTLE KING SIDE. "
2270 PRINT"        'Q' - TO CASTLE QUEEN SIDE. "
2280 PRINT"        'X' - TO EXHANGE PIECES AND LET THE COMPUTER
2290 PRINT"        'S' - TO LET THE COMPUTER PLAY BY ITSELF. "
2300 PRINT"        'M' - TO MODIFY THE BOARD ENTER THE SQUARE FOLLOWED BY "
2310 PRINT"                  C, P, OR E  FOR COMPUTER, PLAYER, OR EMPTY"
2320 PRINT"                  AND S,P,N,B,R,Q,K  FOR SQUARE,PAWN, ETC. "
2330 PRINT"        'Z' - TO ESCAPE MODIFY AND LET THE COMPUTER MOVE. "
2340 PRINT"        'I' - TO GET INSTRUCTIONS AGAIN "
2350 PRINT"        'L' - TO LOOK AT OR CHANGE LEVEL OF PLAY"
2360 REMPRINT"4. TO PROMOTE TO P,N,B,R,Q  ENTER THE LETTER WHEN PROMPTED. "
2370 INPUT"HIT ENTER TO CONTINUE";EN$:PRINT
2380 PRINT"4. TO PROMOTE TO P,N,B,R,Q  ENTER THE LETTER WHEN PROMPTED. "
2390 PRINT"5. TO CAPTURE 'EN PASSANT' SPECIFY THE 'FROM' - 'TO' SQUARES. "
2400 PRINT"6. LEVELS OF PLAY ARE FROM 01 TO 24. "
2410 PRINT"7. COMPUTER ASSUMES MATE IF KING IS LEFT IN CHECK
          SO BE SURE TO WATCH FOR THE CHECK MSG. "
2420 PRINT"8. IF A MOVE IS ILLEGAL OR AN ENTRY ERROR IS MADE
          SIMPLY TYPE IN A NEW MOVE.  A MOVE MAY BE
          STARTED OVER BY FORCING AN ERROR. (E.G. "9").
2430 PRINT"9. IF <BREAK> IS HIT DURING THE GAME, TYPE 'GOSUB900:CONT' TO"
2435 PRINT"   DRAW BOARD AND CONTINUE. "
2440 PRINT"10. YOU HAVE A CHOICE OF WHITE OR BLACK,THE COMPUTER
           WILL ALWAYS BE AT THE TOP OF THE SCREEN "
2450 PRINT:PRINT:INPUT"HIT ENTER TO CONTINUE GAME";EN$
2460 RETURN
2480 I=-I:GOSUB2490:GOSUB900:RETURN
2490 L=0:FORJ=1TO8:FORK=1TO8:L=L+1:IFA(J,K)<>1THENC(L)=-A(J,K):ELSEC(L)=A(J,K)
2500 NEXT:NEXT
2510 L=65:FORJ=1TO8:FORK=1TO8:L=L-1:A(J,K)=C(L):NEXT:NEXT
2520 RETURN
65529 END
```

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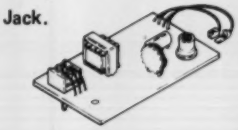

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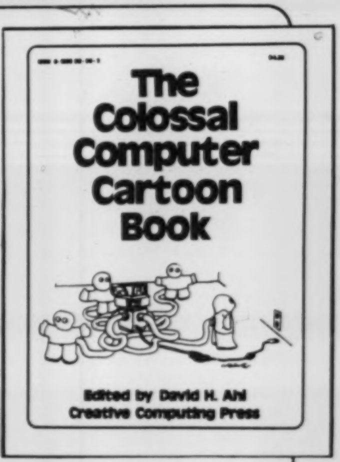

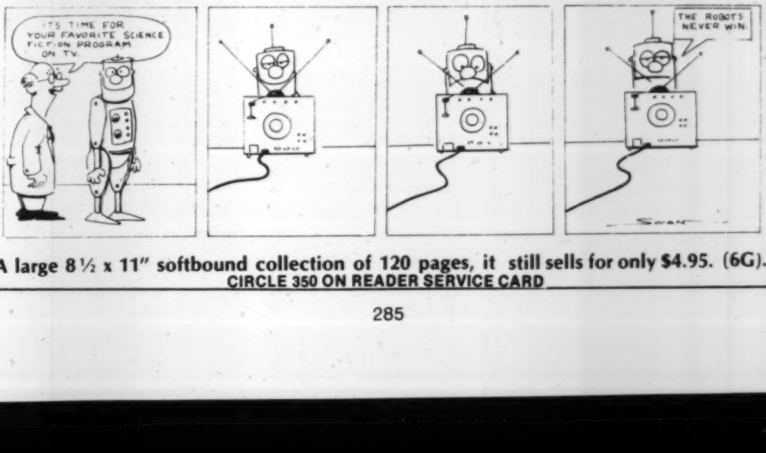
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How to Solve It—With the Computer

Mathematical Sieves

Donald T. Piele

> *"No branch of number theory is more saturated with mystery and elegance than the study of prime numbers: those exasperating, unruly integers that refuse to be divided evenly by any integers except themselves and 1."*
> *—Martin Gardner*

Problems dealing with the study of numbers are often very good problems for students to investigate with a computer. They tend to be easy to state and to understand, and the resulting computer algorithms are "short and sweet." As a bonus, they can dramatically illustrate the difference in efficiency between two different computer algorithms. A classic example can be found in the study of prime numbers.

Prime numbers are those positive integers—2, 3, 5, 7, 11, and so on—which *cannot* be represented by multiplying two smaller numbers. The remaining positive integers, those that can be so represented—4, 6, 8, 9, 12 and so on,—are called composite numbers. The primes are scattered along the positive integer line in a way that has frustrated all attempts at a complete description. Euclid proved that there is an unending supply of prime numbers, but, to this day, no one has been able to find a pattern which explains how they are laid out. What is the 100th prime? To find out you must generate all 99 primes before it.

Five problems will be discussed this month which deal with the generation and study of prime and related numbers; after each discussion, a problem is posed for the student to solve. Solutions will appear next month.

Prime Factorization

Every positive integer other than 1 can be factored into prime factors in exactly one way. For example,

$$6 = 2 \times 3$$
$$12 = 2 \times 2 \times 3$$
$$15 = 3 \times 5$$

What procedure will produce a unique prime factorization for any positive integer?

The Algorithm

To find the prime factorization of a number N, divide it first by 2. If N/2 = INT(N/2), then 2 divides N evenly and we have N = 2 x M, where M is an integer. Next we can use the same test on M to see if it has 2 as a divisor. If so then N = 2 x 2 x K, where K is an integer. We continue extracting factors of two until division by 2 no longer gives an integer. Thus N = 2^r x L where r is the largest power of 2 that divides N evenly. We then switch to 3 and find all the divisors of 3 by the same procedure. Thus N = 2^r x 3^s x Q where s is the largest power of 3 that divides N evenly. Continue in this manner until N has been completely factored in its unique prime factorization.

The Problem: Prime Factorization

Write a computer program that asks the user to input an integer greater than 1 and which then generates and prints out its unique prime factorization.

Prime Numbers

A traditional way of generating the prime numbers is to print 2 (since it is the only even prime) and then begin testing the odd numbers starting with 3 and rejecting every one that is found to be composite.

In checking whether an odd number N is composite it is only necessary to divide by the odd numbers (why?) less than or equal to the square root of N. For example, to test whether 99 is a prime it is only necessary to test whether 99/I = INT(99/I) for I=3,5,7,9. The reason for this is simple: If 99 = N x M, then N or M must be less than or equal to the square root of 99.

Actually, it is not necessary to make the test for I=9 since the test would have failed already for I=3, but this requires that one know that 9 is not prime, and this information can only be known by keeping a list of the primes as they are tested. This can be done with a slight modification of the same algorithm.

The Algorithm

To test whether N is prime (N>2), check whether N is evenly divisible by an odd number from 3 up to the square root of N. If it is not, then it is prime. Alternatively, if one

---

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keeps a list of the primes as they are generated, it is sufficient to check whether N is divisible by any previous prime less than or equal to the square root of N.

The Problem: Prime Numbers

Write a program that uses the above algorithm to generate all the prime numbers between 2 and 1000. Write two versions of the program—one which uses the previous primes as divisors and one that does not. Compare their speeds.

The Sieve of Eratosthenes

Over 2000 years ago an Alexandrian geographer-astronomer and friend of Archimedes named Eratosthenes discovered a very simple procedure for listing the prime numbers that is still used today. It is a much faster procedure than the one described above and remains in basically the same form as one of the most popular computer algorithms for the generation of primes.

The Algorithm

The algorithm is called the Sieve because the composite numbers are sifted out and the prime numbers are the only ones left. It is very easy to describe: Begin by writing down the positive integers beginning with 2, 3, 4, 5, 6 and so on. Select the number 2—the first available number—and cross out all multiples of 2 (the even numbers 4, 6, 8...) from the list. Now select the next available number—in this case 3—and cross out all multiples of 3 (6, 9, 12, 15,...). (Some of the numbers have already been crossed out from the previous step.)

Repeat this procedure for the next available number, 5, and eliminate its multiples; then the multiples of 7, and so on. The numbers that are not crossed out are the prime numbers. It is interesting to note that the first new number that is eliminated by 3 is 9, by 5 is 25, and by 7 is 49. All lower multiples have already been eliminated (why?). Table 1 shows what is left after three passes through the numbers from 2 to 25.

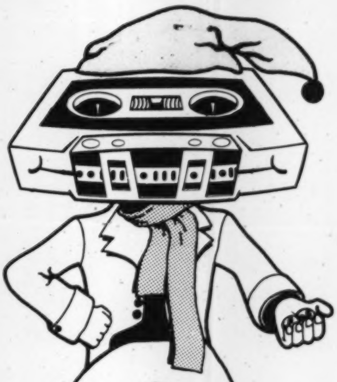
Over 2000 years ago an Alexandrian geographer-astronomer and friend of Archimedes named Eratosthenes discovered a very simple procedure for listing the prime numbers that is still used today.

The Problem: The Sieve of Eratosthenes

Write a computer program that uses the Sieve of Eratosthenes to generate the prime numbers between 2 and 1000. Time the program and compare it with the previous programs for generating primes.

Table 1.

2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
2	3		5		7		9		11		13		15		17		19		21		23		25
2	3		5		7				11		13				17		19				23		25
2	3		5		7				11		13				17		19				23		



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A one-hour LP record of eight synthesizers may change your views about computer music forever

Binary Beatles

by David Ahl

Computer music. Who needs it? It's mostly boring beep, beep, beeps or wildly modern stuff. It's certainly nothing you'd want to listen to more than once. That's what I thought about computer music and most of my friends agreed.

In 1978 I entered Yankee Doodle Dandy into my Software Technology system just to be different. Dick Moberg heard of it and asked me to perform in the Philadelphia Computer Music Festival. I agreed expecting to be the only one with something out of the ordinary. I was wrong.

Computer Accompanist

Nine individuals and groups performed in the festival. There were the usual Bach pieces but even they were different. Gooitzen van der Wal performed the last movement of the 2nd Bach Suite in a unique way. He played the flute solo while using the computer as accompaniment.

Then Dorothy Siegel did the same thing, playing the clarinet solo part of Wanhal's Sonata in b flat. The audience went wild.

Hal Chamberlin played Bach's Tocatta and Fugue in d minor. But also with a difference. He used a large computer before hand to "compute" the waveform of every instrument playing every note. It took one hour of computation time for each two minutes of playback time. The result could hardly be distinguished from the organ in the Hapsburg Cathedral.

Don Schertz had a home brewed synthesizer truly mounted on a breadboard that allowed him to control 25 parameters of each note. It produced spectacular sounds in his arrangement of Red Wing.

Singing Computer

In 1962, D.H. Van Lenten at Bell Laboratories produced the first talking computer. Bell engineers taught it to recite the soliloquy from Hamlet. Then they went one step further and taught it to sing Daisy both alone and accompanied by another computer. This was also performed at the festival.

Yes, the Beatles were represented. Andrew Molda played Hey Jude on his COSMAC VIP system with a program called PIN-8 (Play it Now).

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Mathematical Sieves, continued...

Table 2.

2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
2		4	5		7		9	10		12			15	16	17		19		21	22			25
2		4	5				9	10		12			15	16			19			22			25
2		4	5				9	10		12				16			19			22			

Gauss was able to guess one of the most celebrated facts about primes.

Table 3.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1		2		5		7		9		11		13		15		17		19		21		23		25
1		3				7		9				13		15				19		21				25
1		3				7		9				13		15						21				25

Random Sieves

An examination of the Sieve of Eratosthenes shows that the fraction of the integers eliminated by each sieving number is its own reciprocal. Thus, 2 sieves out half of the remaining numbers while 3 sieves out one-third, and 5 sieves out one fifth. This is done, of course, in a very deterministic way. David Hawkins [2] wondered what kind of numbers would be left if the integers were eliminated in a random fashion. Here is how his procedure works.

The Algorithm

Begin as in the Sieve of Eratosthenes with the consecutive integers 2, 3, 4, 5, 6 and so on. Again pick 2 as the first sieving number. Now instead of crossing out every other number (4, 6, 8 and so on) begin going down the list of integers after 2 and flip a fair coin to determine whether to "keep it" or "cross it out." In this way you will expect to eliminate half of the numbers, but in a random fashion.

The major difference here over the Sieve of Eratosthenes is that you won't know which ones will remain as we did before. The next step is to take the next remaining number that has not been crossed out—say it was 4—as your next sieving number. Now use a coin that comes up "cross it out" 1/4th of the time and lands on "keep it" 3/4ths of the time. Flip the coin for each remaining number that follows 4 and follow the "keep it" or "cross it out" instructions. This time we can expect to remove 1/4th of the remaining numbers. Proceed in the same fashion with the remaining numbers. The integers that are left by this process are called "random primes." Table 2 shows a typical random series after three passes through the numbers 2 to 25.

The Problem: Random Primes

Write a program that uses the above algorithm to generate a set of random primes between 2 and 1000.

Lucky Numbers

Stanislaw M. Ulam is a distinquished contemporary mathematician who has had a life-long love affair with problem solving. His interest in problems in both modern and classical mathematics spans nearly all fields of mathematics. He wrote a book, *Problems In Modern Mathematics* [3], which is filled with a wide variety of mostly unsolved problems that he collected in the years 1936-1959.

As a prominent member of the team of mathematicians at the Los Alamos Scientific Laboratories during and after World War II, Ulam was one of the pioneers in the use of computers as an aid in the search for mathematical conjectures.

One of the problems in his book deals with the properties of a subset of the positive integers called Lucky Numbers. They are generated by using a variation of the Sieve of Eratosthenes.

The Algorithm

Begin with the sequence of all integers 1, 2, 3, 4, 5 and so on, and strike out every second number (i.e. all the even numbers). The first number remaining (apart from 1, which is not counted) is 3. Now strike out every third integer, counting only the remaining ones (i.e. strike out 5, 11, 17, etc.).

In the remaining sequence the first number not used before is 7. Strike out every seventh number, counting again only from the remaining ones. This will eliminate 19, etc. This process is repeated.

The numbers that remain are called Lucky Numbers. Table 3 shows what is left after three passes through the numbers from 2 to 25.

The Problem: Lucky Numbers

Write a program that will generate the Lucky Numbers between 1 and 1000. The first 10 Lucky Numbers are 1, 3, 7, 9, 13, 15, 21, 25, 31, and 33.

The Prime Number Theorem

Karl Friedrich Gauss, an eighteenth century German mathematician, ranks as one of the greatest problem solvers of all time. Much of his success in the field of number theory can be attributed to his interest in examining special cases in which he would often build up long lists of numbers and examine their properties. From one such table Gauss was able to guess one of the most celebrated facts about primes—The Prime Number Theorem.

The theorem tells us how many primes we can expect to find in our list of primes up to any specified number N. It states that there are about N/log(N) primes before N. The approximation becomes more precise as the value of N grows.

The random primes and Lucky Numbers have been shown to have the same density. Thus, if you count up the Lucky Numbers or the random primes that appear before N you can expect to find approximately N/log(N). This result is not completely surprising given the similarity in the way these numbers are generated using the sieve.

The Problem: The Prime Number Theorem

Write a program that will construct a table of the number of prime numbers, random primes, and Lucky Numbers that appear before N for N=100, 200, 300...1000, and compare this number with the N/log(N) value predicted by the Prime Number Theorem.

The Fastest Prime Number Generator

In a class on computer problem solving, I invited students to create a program that would generate the primes between 2 and 1000 in the fastest way possible. Everyone, it seems, has a prime generating program, but many of them—including text book programs—are terribly slow. The best solution

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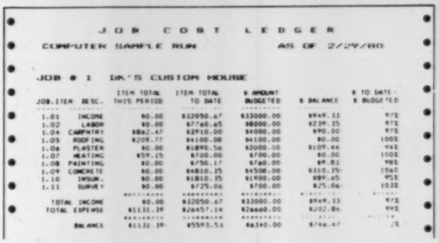

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 JOB.ITEM  DESC.   THIS PERIOD      TO DATE    BUDGETED   $ BALANCE    $ BUDGETED
 -----  --------   -----------  -----------  ----------  ----------   ----------
  1.01    INCOME         $0.00    $32050.67   $33000.00     $949.33          97%
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  1.04  CARPNTRY       $862.47     $3910.00    $4000.00      $90.00          97%
  1.05   ROOFING       $209.77     $4100.00    $4100.00       $0.00         100%
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  1.11    SURVEY         $0.00      $725.06     $700.00     $25.06-         103%
                   -----------  -----------  ----------  ----------   ----------
      TOTAL INCOME       $0.00    $32050.67   $33000.00     $949.33          97%
     TOTAL EXPENSE    $1131.39    $26457.14   $26660.00     $202.86          99%
                   -----------  -----------  ----------  ----------   ----------
           BALANCE   $1131.39-     $5593.53    $6340.00     $746.47   [illegible]
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CIRCLE 291 ON READER SERVICE CARD

Mathematical Sieves, continued...

from the class was remarkably simple and efficient. The algorithm has only 10 Basic statements. We timed it on a variety of microcomputers to see how long it would take to print the primes out to the screen. Here are our results:

Microcomputer	Time (Seconds)
TRS-80 Level II	11
Atari	10
TRS-80 Color Computer	10
PET CBM	9
Apple II (Applesoft)	8
North Star Basic	5
MBasic/ CP/M	5

The conditions under which the algorithm was tested were as follows:

1) The program was written entirely in Basic with no machine language calls.

2) The even prime (2) was not tested for, but simply printed out. All the remaining odd primes were generated and printed to the screen by the algorithm.

3) The timing was done by typing RUN and starting a stop watch with the press of the Return key. The output to the screen was observed and the timing stopped when the last prime (997) appeared and the program ended.

It would be interesting to see if anyone can write a faster prime generating program. Use the chart above as a guide for comparing the speed of your algorithm with ours. Our algorithm will appear next month and yours will appear in a later issue if you can beat it. Good Luck!

Solutions To Last Month's Problems

How to deal safely with extracting digits from whole numbers was the major theme of last month's article. For example, to isolate the digits in the number 53 one often sees the following technique:

```
TENS = INT(53/10)
UNITS = 53 - 10*TENS
```

This may work fine for two digit numbers, but try isolating all the digits in a four or five digit number this way. You will often find yourself falling into the roundoff trap.

Even authors of text books fall into this trap occasionally. A recent book on problem solving with the computer stated that there are no 4-digit Armstrong numbers. The algorithm that the author used to extract the digits must have been prone to roundoff errors for 4-digit numbers. The truth is there are three 4-digit Armstrong numbers, as the third program listed below shows. If you use the techniques employed below for extracting digits from numbers, you will avoid falling into the roundoff trap.

The solutions beginning on page 294 were written in Microsoft MBasic (Rev. 4.51 - 1977). The same programs will run under Applesoft Basic if the indicated extra statements are deleted. ☐

References

1] Gardner, Martin, *Martin Gardner's Sixth Book of Mathematical Games from Scientific American,* San Francisco: W.H. Freeman and Co. 1971, p. 79.

2] Hawkins, David, "Mathematical Sieves", *Scientific American*, Dec. 1958, p. 105-112.

3] Ulam, S.M., *Problems In Modern Mathematics*, New York: Wiley 1960, p. 120-121.

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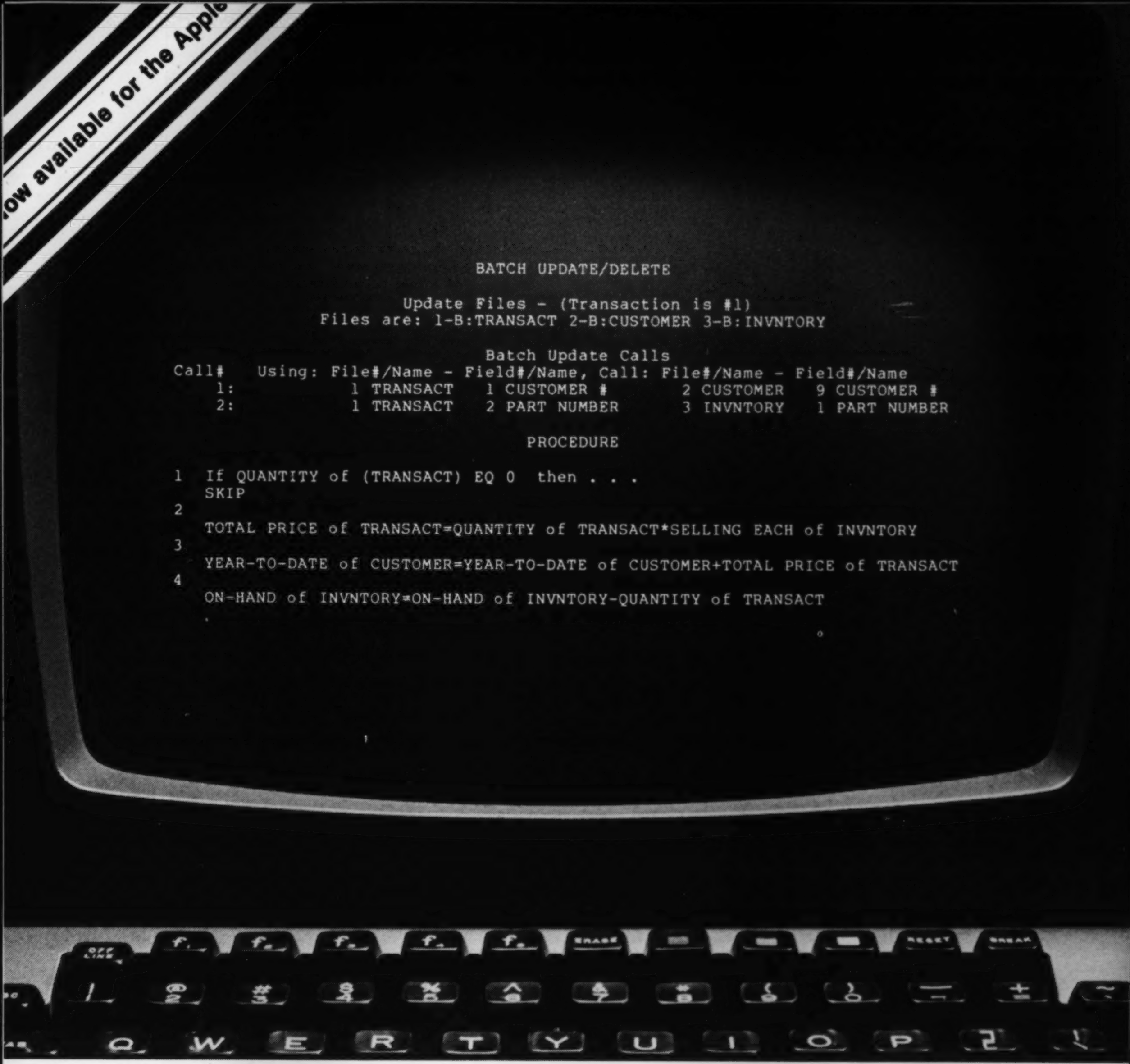

```
                          BATCH UPDATE/DELETE

                  Update Files - (Transaction is #1)
        Files are: 1-B:TRANSACT 2-B:CUSTOMER 3-B:INVNTORY

                          Batch Update Calls
Call#   Using: File#/Name - Field#/Name, Call: File#/Name - Field#/Name
    1:            1 TRANSACT   1 CUSTOMER #       2 CUSTOMER   9 CUSTOMER #
    2:            1 TRANSACT   2 PART NUMBER      3 INVNTORY   1 PART NUMBER

                              PROCEDURE

1   If QUANTITY of (TRANSACT) EQ 0  then . . .
    SKIP
2
    TOTAL PRICE of TRANSACT=QUANTITY of TRANSACT*SELLING EACH of INVNTORY
3
    YEAR-TO-DATE of CUSTOMER=YEAR-TO-DATE of CUSTOMER+TOTAL PRICE of TRANSACT
4
    ON-HAND of INVNTORY=ON-HAND of INVNTORY-QUANTITY of TRANSACT
```

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Mathematical Sieves, continued...

Sum of Digits Squared

```
 10 PRINT "SUM OF DIGITS SQUARED"
 20 PRINT "D. PIELE  JULY 24, 1981"
 30 PRINT
 40 PRINT "This program will find the sum of the digits squared"
 50 PRINT "for any whole number N."
 60 PRINT
 70 INPUT "ENTER A WHOLE NUMBER : ";N$
 80        FOR I=1 TO LEN(N$)
 90            D=VAL(MID$(N$,I,1))      ' D is the Ith digit
 100           SUM = SUM + D*D
 110       NEXT I
 120 :
 130 PRINT "THE SUM OF THE DIGITS SQUARED FOR ";N$;" IS";SUM
 140 END
```

```
SUM OF DIGITS SQUARED
D. PIELE  JULY 24, 1981

This program will find the sum of the digits squared
for any whole number N.

ENTER A WHOLE NUMBER : 123456789
THE SUM OF THE DIGITS SQUARED FOR 123456789 IS 285


ENTER A WHOLE NUMBER : 999999999
THE SUM OF THE DIGITS SQUARED FOR 999999999 IS 729


ENTER A WHOLE NUMBER : 111111111
THE SUM OF THE DIGITS SQUARED FOR 111111111 IS 9
```

The Digital Sum

```
 10 PRINT "THE DIGITAL SUM"
 20 PRINT "D. PIELE JULY 24, 1981"
 30 PRINT
 40 PRINT "This program will add the digits of a number"
 50 PRINT "and check whether the sum is a single digit."
 60 PRINT "If not then the sum becomes the new number and the "
 70 PRINT "process is repeated until the sum is less than 10."
 80 PRINT "The final single digit sum is called the Digital Sum."
 90 PRINT
 100 INPUT "ENTER A WHOLE NUMBER : ";N$
 110       PRINT " ";N$;
 120       L=LEN(N$)
 130           IF L=1 THEN 200
 135          N=0
 140          FOR I=1 TO L
 150               N=N+VAL(MID$(N$,I,1))
 160          NEXT I
 170       PRINT
 180       N$=STR$(N)
 185       N$=RIGHT$(N$,LEN(N$)-1)    'Not needed in Applesoft
 190       GOTO 110
 200 PRINT "  IS THE DIGITAL SUM."
 210 END
```

```
THE DIGITAL SUM
D. PIELE JULY 24, 1981

This program will add the digits of a number
and check whether the sum is a single digit.
If not then the sum becomes the new number and the
process is repeated until the sum is less than 10.
The final single digit sum is called the Digital Sum.

ENTER A WHOLE NUMBER : 123456789
 123456789
 45
 9  IS THE DIGITAL SUM.


ENTER A WHOLE NUMBER : 99999999999999999999999999999999999
 99999999999999999999999999999999999
 315
 9  IS THE DIGITAL SUM.


ENTER A WHOLE NUMBER : 88888888888888888888888888888888888
 88888888888888888888888888888888888
 280
 10
 1  IS THE DIGITAL SUM.
```

Armstrong Numbers

```
10 PRINT "ARMSTRONG NUMBERS"
20 PRINT "D. PIELE  JULY 24, 1981"
30 PRINT
40 PRINT "An N-digit number is called an Armstrong number "
50 PRINT "if the sum of the N-th power of each digit is "
60 PRINT "equal to the number itself."
70 PRINT "This program will find all N-digit Armstrong Numbers. "
80 PRINT
90 INPUT "ENTER A VALUE FOR N : ";N
100 :
110      PRINT "THE";N;" DIGIT ARMSTRONG NUMBERS ARE : "
120      FOR I=10^(N-1) TO 10^N -1
130          I$=STR$(I)
140          I$=RIGHT$(I$,LEN(I$)-1)  'Not necessary in Applesoft
150          D=LEN(I$)
160          T=0
170             FOR X=1 TO D
180                S=VAL(MID$(I$,X,1))  'Pick off each digit
190                T=T + S^N
200             NEXT X
210      IF ABS(I-T)<.1 THEN PRINT I,
220      NEXT I
230 END
```

```
ARMSTRONG NUMBERS
D. PIELE  JULY 24, 1981

An N-digit number is called an Armstrong number
if the sum of the N-th power of each digit is
equal to the number itself.
This program will find all N-digit Armstrong Numbers.

ENTER A VALUE FOR N :  2
THE 2  DIGIT ARMSTRONG NUMBERS ARE :


ENTER A VALUE FOR N :  3
THE 3  DIGIT ARMSTRONG NUMBERS ARE :
 153           370           371           407

ENTER A VALUE FOR N :  4
THE 4  DIGIT ARMSTRONG NUMBERS ARE :
 1634          8208          9474
```

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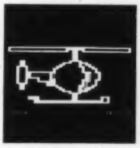

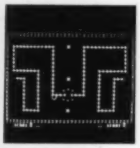

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Mathematical Sieves, continued...

Balanced Numbers

```
10 PRINT "BALANCED NUMBERS"
20 PRINT "D. PIELE, JULY 24, 1981"
30 PRINT
40 PRINT "A number is said to be Balanced if the largest"
50 PRINT "digit in the number is equal to half of the sum of all"
60 PRINT "the digits."
70 PRINT "This program finds all the Balanced numbers between 1 and N."
80 PRINT
90       INPUT "ENTER A VALUE FOR N : ";N
100        FOR I=1 TO N
110            I$=STR$(I)
120            I$=RIGHT$(I$,LEN(I$)-1)  'Not needed in Applesoft
130            L=LEN(I$)
140              MAX=0 : SUM = 0
150                FOR J=1 TO L
160                    D=VAL(MID$(I$,J,1))
170                    SUM = SUM + D
180                    IF D>MAX THEN MAX = D
190                NEXT J
200             IF SUM =2*MAX THEN PRINT I$,
210        NEXT I
220 END
```

```
BALANCED NUMBERS
D. PIELE, JULY 24, 1981

A number is said to be Balanced if the largest
digit in the number is equal to half of the sum of all
the digits.
This program finds all the Balanced numbers between 1 and N.

ENTER A VALUE FOR N :  500
11            22            33            44            55
66            77            88            99            101
110           112           121           123           132
134           143           145           154           156
165           167           176           178           187
189           198           202           211           213
220           224           231           235           242
246           253           257           264           268
275           279           286           297           303
312           314           321           325           330
336           341           347           352           358
363           369           374           385           396
404           413           415           422           426
431           437           440           448           451
459           462           473           484           495
```

Palindromes

```
    PALINDROMES
    D. PIELE  JULY 24, 1981

    A number is called a Palindrome if it reads the same
    backwards as forwards. If a number is not a Palindrome
    it can usually be made into one by simply reversing the
    digits and adding the two numbers together.
    If that doesn't work then the reversal process is repeated.

    The following program examines all three digit numbers
    and prints out the total number that require 0,1,2,
    3,4,5-10, and over 10 reversals before they become
    Palindromic - if ever.

    REVERSAL COUNT FOR THE NUMBERS FROM 100 TO 999

    RESERVALS                 TOTAL IN THIS CATEGORY
     0                                  108
     1                                  263
     2                                  301
     3                                  149
     4                                  67
    5-10                                68
    >11                                 44
```

```
10 PRINT "PALINDROMES"
20 PRINT "D. PIELE  JULY 24, 1981"
30 PRINT
40 PRINT "A number is called a Palindrome if it reads the same "
50 PRINT "backwards as forwards. If a number is not a Palindrome"
60 PRINT "it can usually be made into one by simply reversing the"
70 PRINT "digits and adding the two numbers together."
80 PRINT "If that doesn't work then the reversal process is repeated."
90 PRINT
```

```
100 PRINT "The following program examines all three digit numbers"
110 PRINT "and prints out the total number that require 0,1,2,"
120 PRINT "3,4,5-10, and over 10 reversals before they become"
130 PRINT "Palindromic - if ever."
140 PRINT
150   DEFDBL X-Z      'Not necessary in Applefsoft
160 FOR N=1 TO 1000
170          C=0
180        N$=STR$(N)
190        N$=RIGHT$(N$,LEN(N$)-1)  'Not needed in Applesoft
200        L=LEN(N$)
210         FOR J=1 TO INT(L/2)
220             IF MID$(N$,J,1)<>MID$(N$,L+1-J,1) THEN 250
230         NEXT J
240           GOTO 350  ' N$ is now Palindromic
250         R$=""
260           FOR I=L TO 1 STEP -1
270              R$=R$+MID$(N$,I,1)   'Reverse the number
280           NEXT I
290           X=VAL(N$) : Y=VAL(R$)
300           Z=X+Y
310           N$=STR$(Z)
320               C=C+1                 'Count the reversals
330            IF C>10 THEN 350
340             GOTO 190
350 '********* COUNT THE REVERSALS **********
360    IF C<5 THEN C(C)=C(C)+1
370    IF C>4 AND C<11 THEN C(5)=C(5)+1
380    IF C>10 THEN C(6)=C(6)+1
390     NEXT N
400 '********* PRINT OUT THE RESULTS **********
410 PRINT "REVERSAL COUNT FOR THE NUMBERS FROM 100 TO 999"
420 PRINT
430 PRINT "RESERVALS                    TOTAL IN THIS CATEGORY"
440    FOR I=0 TO 4
450      PRINT I;TAB(30);C(I)
460    NEXT I
470 PRINT "5-10";TAB(30);C(5)
480 PRINT ">11";TAB(30);C(6)
490 END
```

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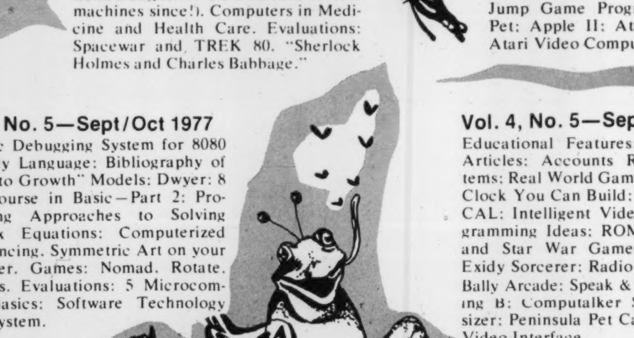

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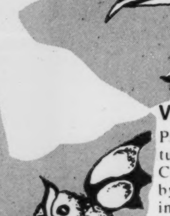

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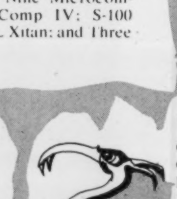

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Multiple Regression Analysis Simplified: Budget Management: Sports Predictions: PEEKing and POKEing for Video Displays: Interview with Michael Shrayer: Computers and Education—Questions of Value: Game Programs for Gold Mine and Atom 20. Evaluations: Heathkit H-8: Thinker Toys Floppy Disk: Electric Pencil: Western Digital Pascal Chip Set: Four Computer Music Records.

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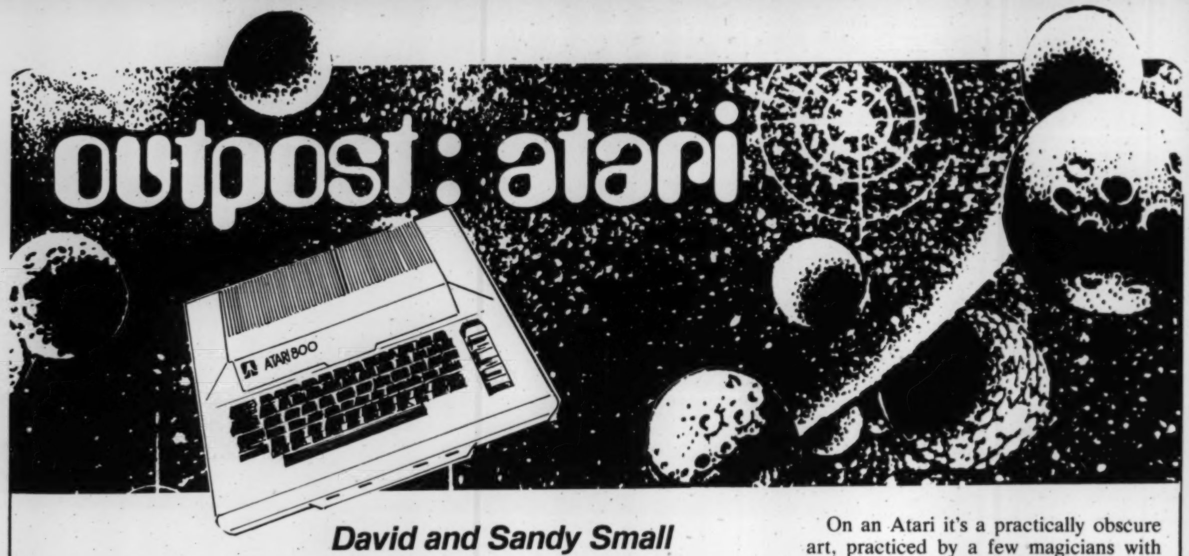


outpost : atari

David and Sandy Small

Last month we discussed the way Atari Basic handles color, and why normal Basic programs are limited to five colors. This month we describe a method you can use in your own Basic programs to allow up to 128 colors on the screen at one time.

A refresh of the TV screen occurs 60 times per second. The electron beam starts at the upper left hand corner, goes all the way right for one scan line, then does the next line down left to right, and so on. CTIA is responsible for feeding data to the TV in synchronization with this scan. For every dot plotted onscreen, CTIA looks again to its hardware color registers to find the color.

While a screen refresh is a darn fast thing to us, it isn't particularly fast compared to the speed of the 6502 processor. We must not think of a screen refresh as an instantaneous event; rather, we must think in terms of how long the 6502 sees it taking, which is roughly an Ice Age or so.

If we could change a color register that CTIA was using halfway through a screen refresh, the screen below that point would reflect CTIA using the new colors. For example, if we were in Graphics 7 and modified the background hardware register halfway through a refresh from green to blue, the screen will shift from green to blue in the middle of the TV frame for all those background points. (Diagram 1.)

If we were to put Basic to work changing the color register as fast as it could:

```
FOR R = 0 to 255: POKE 53274,R:
NEXT R
```

we'd find that Basic wouldn't be able to get more than one change in per frame. This is because it's so slow in execution, and this is why only five colors can be shown at one time if we use just Basic. By the way, that total doesn't include players and missiles.

What's needed here is high speed help to assist Basic in getting a demanding job done. We have to use machine language.

Machine Language

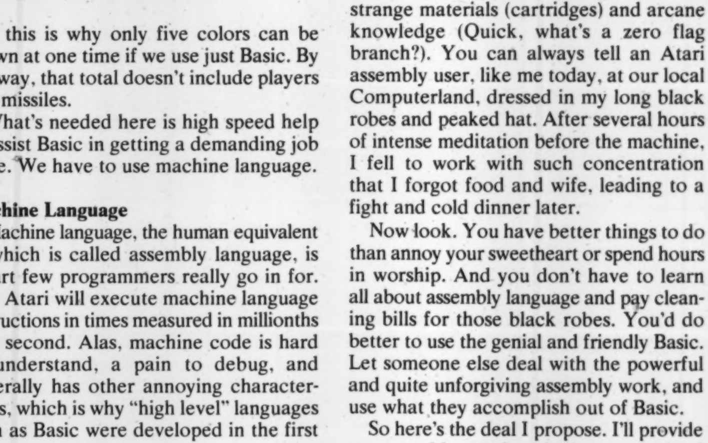
Machine language, the human equivalent of which is called assembly language, is an art few programmers really go in for. The Atari will execute machine language instructions in times measured in millionths of a second. Alas, machine code is hard to understand, a pain to debug, and generally has other annoying characteristics, which is why "high level" languages such as Basic were developed in the first place.

On an Atari it's a practically obscure art, practiced by a few magicians with strange materials (cartridges) and arcane knowledge (Quick, what's a zero flag branch?). You can always tell an Atari assembly user, like me today, at our local Computerland, dressed in my long black robes and peaked hat. After several hours of intense meditation before the machine, I fell to work with such concentration that I forgot food and wife, leading to a fight and cold dinner later.

Now look. You have better things to do than annoy your sweetheart or spend hours in worship. And you don't have to learn all about assembly language and pay cleaning bills for those black robes. You'd do better to use the genial and friendly Basic. Let someone else deal with the powerful and quite unforgiving assembly work, and use what they accomplish out of Basic.

So here's the deal I propose. I'll provide an assembly routine that's easy to load

Diagram 1. One TV refresh (this process happens 60 times/sec).


GREEN
BACKGROUND
BLUE
BACKGROUND
CTIA color register = "green"
CTIA color register is changed to "blue" here

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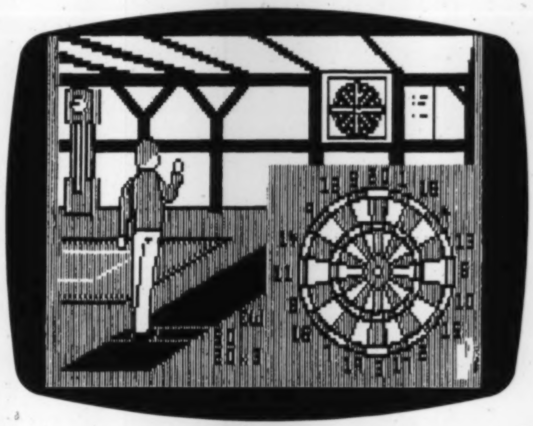

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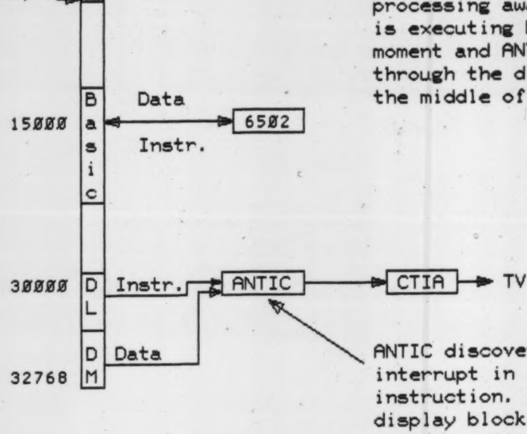
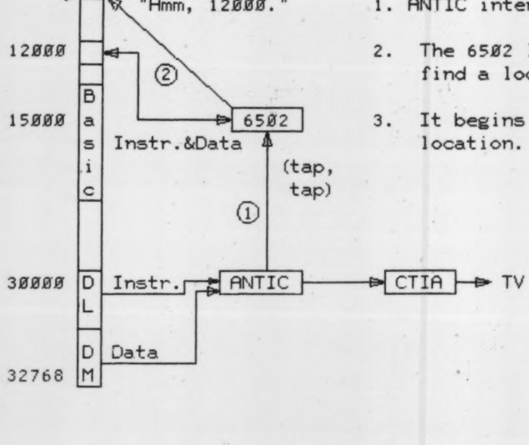


Part 1 of 3. ANTIC and the 6502 are both normally processing away. The 6502 is executing Basic at the moment and ANTIC is midway through the display list, in the middle of a screen refresh.

ANTIC discovers a display list interrupt in its current instruction. It completes that display block until the last scan line.

Diagram 2, part 1 of 3. Display List Interrupt Processing.

Diagram 2, part 2 of 3. Display List Interrupt Processing.



Part 2 of 3.

1. ANTIC interrupts the 6502.
2. The 6502 looks to 512,513 find a location.
3. It begins executing at that location.

and use from Basic. The routine will handle the demands of the 6502 so you don't have to worry about them. By setting up various tables, again from Basic, in a fairly easy way, you can then have as many colors onscreen as you like, all without worrying about assembly, execution speeds, timing, and so on. This is the grey area between assembly and Basic, where the power of assembly helps Basic in a particularly tight spot. There will be more articles on this subject in the future; one, for example, will provide a high speed way to move players or missiles vertically (which you'll recall involves copying a lot of data back and forth in memory, something Basic doesn't do very quickly).

Now on to a discussion of display list interrupts, which is how we're going to pull this off.

Display List Interrupts

The Atari machines really have two processors in them. One is called Antic, and one is the regular 6502. Antic has its own special language and is devoted to display work. Antic works with "display blocks"; a "display block" is a group of horizontal scan lines, all in the same display mode. (Think of it as a long thin horizontal bar, eight scan lines high in Graphics 0, 16 in Graphics 2, and one in Graphics 8. Its height is determined by the size of plotted data in the particular mode.) Atari displays are composed of stacked display blocks. There are 24 stacked blocks in Graphics 7.

Previous articles have dealt with modifying the program Antic uses, called a "display list," to achieve mixed graphics modes and other goodies, such as scrolling. There's one change to the display list we have not yet covered because of its complexity and the requirement of using assembly language: the display list interrupt.

A display list interrupt is flagged by setting the top bit of a display list instruction. (To us Basic programmers, this means add 128 to the instruction.) For example, a Graphics 0 instruction with a DLI added is 2+128, or 130. About any DL instruction can have an interrupt added.

Now what's an interrupt? Well, imagine both Antic and the 6502, toiling away in the fields. Antic finds the top bit of its instruction set (128 added). It goes ahead and completes the current instruction or display block up until the last scan line, it turns and taps the 6502 on the shoulder (doubtless enjoying the moment, after the 6502 has given it so much work over the years) and says, "Drop immediately whatever you're doing, and process this request."

The 6502 looks to locations 512 and 513 in memory. In this it finds 16 bits of address (stored in low, high format, for you advanced coders). The 6502 then jumps

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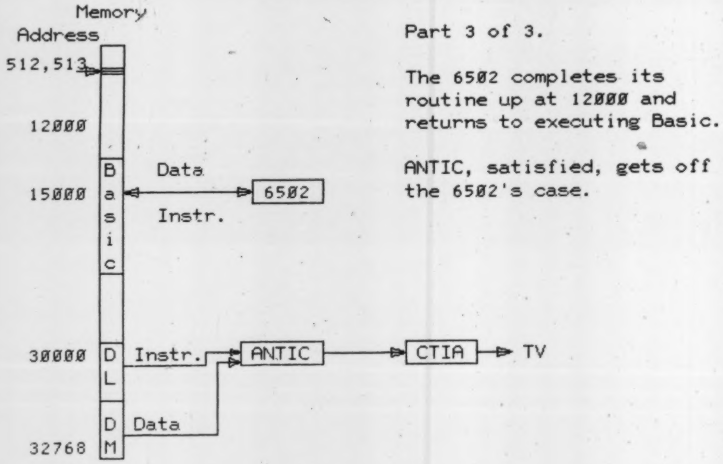
Diagram 2, part 3 of 3. Display List Interrupt Processing.

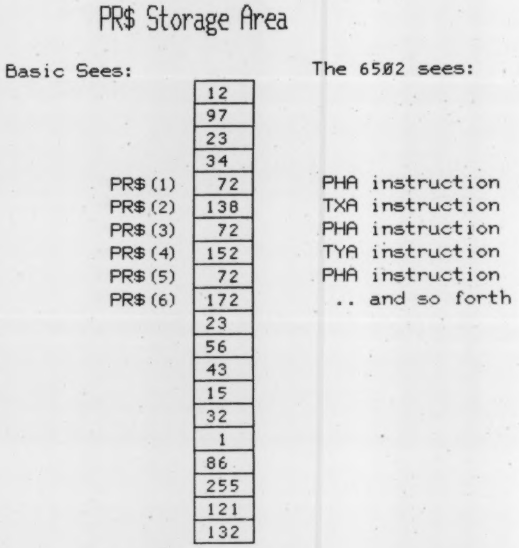


Part 3 of 3.

The 6502 completes its routine up at 12000 and returns to executing Basic.

ANTIC, satisfied, gets off the 6502's case.

Diagram 3. Storing an assembly program as a string.


PR$ Storage Area

Basic Sees:		The 6502 sees:
	12	
	97	
	23	
	34	
PR$(1)	72	PHA instruction
PR$(2)	138	TXA instruction
PR$(3)	72	PHA instruction
PR$(4)	152	TYA instruction
PR$(5)	72	PHA instruction
PR$(6)	172	.. and so forth
	23	
	56	
	43	
	15	
	32	
	1	
	86	
	255	
	121	
	132	

to that address. (Incidentally, a POKE to an Antic location is required to enable this sort of interrupt before the 6502 will be bothered.)

At the location whose address we put in 512 and 513 we must have an assembly language routine waiting to "service the interrupt," or make the 6502 do whatever it is we went to all this trouble to make it do! At the end of this routine, we send the 6502 back to whatever it was doing originally with an RTI (return from interrupt) instruction. (Diagram 2.)

This is probably a new concept to Basic programmers. The best Basic analogy is the TRAP statement. TRAP specifies a line number to GOTO if there is an error, just as 512 and 513 specify where to go if there is an interrupt. Presumably at that line number you have written a routine to handle errors; this is the equivalent of the interrupt service routine. Finally, just as you never know, executing your Basic code, where an error might happen, you also never know when an interrupt will occur.

Here is the first of several overviews of what we are going to do. I'll provide you with an "interrupt service routine" that will handle the above needs, written in assembly. It will reference a table controlled from Basic, and will work on any Atari, at any memory size, and allow you all sorts of different colors onscreen. It will be based on display list interrupts.

The development of an assembly routine that will be as flexible and easy to use as possible and still run on any memory size Atari is quite a task. (hence my hours of worship, etc.) However, I think what I've come up with will serve most users nicely.

Details, Details

First, the assembly routines must be able to fit anywhere in memory, since who knows what memory size your Atari has or how big a Basic program you're using? Hence, I've placed the entire routine into a string (PR$), and I'll let the Atari worry about where to put it.

If you're lost, think of this. A string to us is a collection of characters, generally English words. Inside the machine all those characters are is bytes—one per character. An assembly routine is also just a collection of bytes. The Atari stores a string as a group of bytes, one at a time, in memory; hence, we could make the characters in the string (bytes) be the same as our assembly routine, and thus store the program in the string. (Diagram 3.)

The Basic routine I will provide is called by a GOSUB. It reads the bytes of the assembly program into the string, one at a time. (The CHR$ function takes the contents of the argument and directly stores it in the string, which is just what we want since we don't care about the actual characters.) After it sets the string up, it then ties the table of colors we'll generate (just a second, I'm getting to that) to the program, enables display list interrupts, and returns.

The method I've come up with for specifying colors is to build a table for them, five at a time (for five color registers). Now each time there's a display list interrupt, starting at the top of the table, the next five colors are copied into the hardware registers by servicing the program (in PR$). The idea is that the first display list interrupt causes the first five bytes of the table to be copied into the hardware registers, causing the colors of CTIA to change at that point. The next display list interrupt causes the second group of five color bytes to be copied into the hardware register, again changing the colors, going on down the screen. Hence, by setting interrupts, through modifying the display

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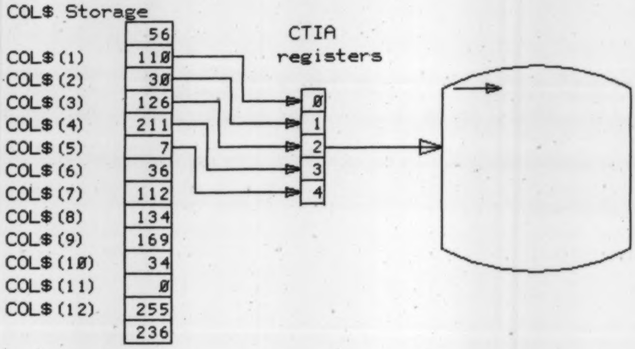
Program 2.

```
10000 REM ************************
10010 REM
10020 REM * DLI DRIVER / DAVE SMALL
10030 REM * YOU MUST DIM AND FILL
10040 REM * COL$ PRIOR TO GOSUB HERE
10050 REM
10060 DIM PR$(50)
10080 REM
10090 REM * READ PROGRAM INTO PR$
10100 REM
10110 READ X
10120 IF X=255 THEN 10300
10130 PR$(LEN(PR$)+1)=CHR$(X)
10140 GOTO 10110
10150 REM
10160 REM * PROGRAM AS BYTES
10170 REM
10180 DATA 72,138,72,152,72
10190 DATA 162,0,173,11,212,201,07,240,3
10200 DATA 174,01,02
10210 DATA 160,0
10220 DATA 189,03,04
10230 DATA 153,22,208
10240 DATA 232,200,192,5,208,244
10250 DATA 142,05,06
10260 DATA 104,168,104,170,104,64
10270 DATA 00,01,02,03,04,05
10280 DATA 255
10290 REM
10300 REM * LINK COL$ TO PR$
10310 REM
10320 P=ADR(PR$)
10330 PHI=INT(P/256)
10340 PLO=(P-PHI*256)
10350 REM
10360 C=ADR(COL$)
10370 CHI=INT(C/256)
10380 CLO=(C-CHI*256)
10390 REM
10400 REM * POKE IN COL$ ADDRESS
10410 REM
10420 PR$(21,21)=CHR$(CLO):REM LOWCOL
10430 PR$(22,22)=CHR$(CHI):REM HI COL
10440 REM
10450 REM * POKE IN PROGRAM LOAD ADDR
10460 REM
10470 PXHI=INT((P+41)/256)
10480 PXLO=(P+41)-(PXHI*256)
10490 PR$(16,16)=CHR$(PXLO):REM XLO
10500 PR$(17,17)=CHR$(PXHI):REM XHI
10510 PR$(33,33)=CHR$(PXLO):REM XLO
10520 PR$(34,34)=CHR$(PXHI):REM XHI
10530 REM
10540 REM * POKE IN INTERRUPT ADDRESS
10550 REM
10560 POKE 512,PLO
10570 POKE 513,PHI
10580 REM
10590 REM * ENABLE INTERRUPTS (ANTIC)
10600 REM
10610 POKE 54286,128+64
10620 REM
10630 REM * ALL SET! RETURN.
10640 REM
10650 RETURN
10660 REM ********************
```



At the start of the refresh, the 6502 is interrupted. The routine, realizing it's the start of a refresh, starts at the top of the COL$ table and copies five colors to the CTIA registers, where they are used for plotting.

Diagram 4. COL$ multiple color interrupt handling.

Program 2A. Assembler Routine for Display List Interrupts from Program 2.

```
PHA                 48H  72D
TXA                 8AH  138D
PHA                 48H  72D
TYA                 98H  152D
PHA                 48H  72D
LDX #0              A2H  162D
                    00H  0D
LDA $D40B           ADH  173D
                    0BH  11D
                    D4H  212D
CMP #7              C9H  201D
                    07H  7D
BEQ SKIP            F0H  240D
                    03H  3D
LDX $0102           AEH  174D
                    01H  1D
                    02H  2D
SKIP LDY #0         A0H  160D
                    00H  0D
LOOP LDA $0304,X    BDH  189D
                    03H  3D
                    04H  4D
STA $D016,Y         99H  153D
                    16H  22D
                    D0H  208D
INX                 E8H  232D
INY                 C8H  200D
CPY #5              C0H  192D
                    05H  5D
BNE LOOP            D0H  208D
                    F4H  244D
STX $0506           8EH  142D
                    05H  5D
                    06H  6D
PLA                 68H  104D
TAY                 A8H  168D
PLA                 68H  104D
TAX                 AAH  170D
PLA                 68H  104D
RTI                 40H  64D
(SCR1)              00H  0D
(SCR2)              01H  1D
(SCR3)              02H  2D
(SCR4)              03H  3D
(SCR5)              04H  4D
(SCR6)              05H  5D
(END)               FFH  255D
```

list from Basic, you can change colors any time you like from one display block to the next. This lets you get as many colors on the screen as you like, oriented towards display blocks. It can be thought of as a color display list. (Diagram 4.)

Next, how shall we set up the table? Let's just use another string, COL$. The first five bytes (characters) of the string will thus correspond to the first display list interrupt colors, the next five bytes to the next five, and so on. Since my routine can address a maximum of 255 bytes this means we have a total of 255/5 = 51 interrupts, which is plenty, believe me. (If not, go buy a robe.)

The next problem is how the assembly routine figures out when we are at the top of the screen, in order to know when to begin at the top of the table (string) again. This is done by setting an interrupt at the very first DL instruction onscreen, which is a 112 (eight blank scan lines). There is a hardware register called VCOUNT which tells us which scan line we are on, from the top of the screen; we read it, and if it corresponds to the blanking line at screen top, we know to start at the beginning of the table again. The routine requires this interrupt to be set. If it isn't, random colors will be generated as the 6502 sails past the end of COL$, cheerfully gobbling up loose data and using it to determine color/lum.

The Basic subroutine is called *after* you set up COL$, which is the table of colors. (It requires the location of COL$ be tied down in memory before it tells the assembly program where the color table is.) Then it returns to you. See Program Listing 2. (Program 1 was in last month's column).

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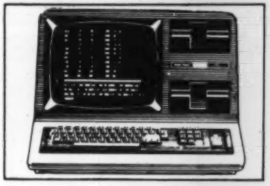

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Everything is now ready. Place your interrupts where you need a color register change, make sure you have the colors ready in the table (COL$), and the assembly routine will do the rest. The moment the display list is modified, the process of copying into hardware registers begins and the colors will change onscreen.

Since this is a confusing process involving many new ideas, let's take a step back and get an overview of the entire process as we've covered it so far. This will, I hope, clear up any confusing points about how to use the routine.

Basic keeps "O.S. shadow registers" of the colors in the five hardware registers. When do we do a SETCOLOR, we change these O.S. registers. At the start of each TV refresh, 60 times a second, these shadow registers are copied by the operating system into the hardware registers. Now here the colors would stay, unchanged, for CTIA to look at, except for the special assembly routine we have.

The routine requires the "blank eight lines" instruction executed at the top of the frame to have an interrupt. Antic does that display block, generating blank lines, and at the end of it interrupts the 6502. The 6502 trots over to COL$, pulls out five bytes from the beginning of the tables (since this is the top of the screen), and copies them into the hardware registers. At that point the colors being generated by CTIA change to the new values just copied in.

Now again here things will stay until the next refresh unless we place another display list interrupt somewhere, and have five more colors ready in COL$. If we do, at the the end of that block the color register will again change, and so on. At the end of the refresh the O.S. register will once again (futilely) be copied into the hardware registers, just to be overridden by our routine again, and again.

Program 3.

```
100 REM * PROGRAM 3.
110 REM * SETS TWO COLORS FOR GR.0
120 REM
130 DIM COL$(50)
140 REM
150 REM * COLOR GROUP 1.
155 REM * CHARS=GREEN,BORDER=RED
160 REM
170 COL$(1)=CHR$(0):REM UNUSED
180 COL$(2)=CHR$(10):REM LUM
190 COL$(3)=CHR$((12*16)+6):REM COLOR
200 COL$(4)=CHR$(0):REM UNUSED
210 COL$(5)=CHR$((2*16)+6):REM BORD
220 REM
230 REM * COLOR GROUP 2.
235 REM * CHARS=ORANGE,BORDER=BLUE
240 REM
250 COL$(6)=CHR$(0):REM UNUSED
260 COL$(7)=CHR$(10):REM LUM
270 COL$(8)=CHR$((3*16)+6):REM COLOR
280 COL$(9)=CHR$(0):REM UNUSED
290 COL$(10)=CHR$((7*16)+6):REM BORD
300 REM
310 REM NOW CALL DLI DRIVER
320 REM
330 GOSUB 10000
340 REM
350 REM NOW POKE IN INTERRUPT AT
360 REM TOP;GET DISPLAY LIST START
365 REM
370 START=PEEK(560)+256*PEEK(561)
380 POKE START,112+128
390 REM
400 REM NOW POKE IN INTERRUPT HALWAY
410 REM DOWN LIST (START+6+15)
420 POKE START+6+15,2+128
430 REM
440 REM ROUTINE IS NOW RUNNING.
450 REM
500 STOP
```

We must determine where we want a color change, what color register must change (for remember the color registers are used differently between graphics modes), and plug in the right values to make a multi-colored screen.

Now for an example. This one will be in Graphics 0, the character mode. It'll plot the top section of the screen in one color, the bottom in another.

Graphics 0 uses the same locations and no one told Antic to quit interrupting. However, as soon as the strings are shifted or destroyed, as during editing, the machine won't have an interrupt service routine anymore, and it will quietly die. (Use RESET to avoid this.) The graceful way to exit the multicolor mode, by the way, is to remove the interrupts from the display list.

For the next demonstration let's escalate things and put 16 colors onscreen at once, in Graphics 0. We'll make each of the first 16 Graphics 0 display blocks a different color.

We will thus need 16 interrupts; the one at the top of the screen (112), the one at the first true Graphics 0 instruction, which is 66 (66=64+2; the 64 added to the 2, like the 128, is a modifier for display memory loading), and 14 more in the Graphics 0 (2) instructions.

COL$ will be length 16*5, or 80, since we have 16 interrupts.

Instead of 80 COL$=CHR$'s we will use instead a short loop. Remember a change of 16 is five color registers as listed in Table 1 (this is copied from the inside back cover of the Basic manual).

We'll need two groups of five colors stored in COL$. The first will cover the

Table 2.

Group 1

Col reg 0, unused	COL$(1)=CHR$(0)
Luminance of characters = 10	COL$(2)=CHR$(10)
Backgnd color-lum of green, which is color #12, intensity 6.	COL$(3)=CHR$(12*16)+6
Col reg 3, unused	COL$(4)=CHR$(0)
Border Color reg, orange at 6 Orange = color 2.	COL$(5)=CHR$(2*16)+6

Group 2

Col reg 0, unused	COL$(6)=CHR$(0)
Col reg 1, lum = 10	COL$(7)=CHR$(10)
Col reg 2, red at 6	COL$(8)=CHR$((3*16)+6)
Col reg 3, unused	COL$(9)=CHR$(0)
Col reg 4, border, blue at 6	COL$(10)=CHR$((7*16)+6)

Table 1.

Color Register Number	Function
0	Unused.
1	Luminance of characters. Color is same as reg 2.
2	Color and lum of backgnd behind characters. Not border.
3	Unused.
4	Border color and lum.

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CIRCLE 309 ON READER SERVICE CARD

colors from the first display list interrupt, at the top of the screen, to the second interrupt midway down the screen. The second will cover from midscreen to the bottom. COL$ is set up with the colors in Table 2.

Our colors are now set up. We call the routine with GOSUB 10000. It returns to us shortly thereafter. We must now set our interrupts in the display list.

A Graphics 0 display list is shown in Table 3, to help us visualize what we will be modifying.

Hence, we POKE a 112+128 into START+0, to set our first interrupt (the instant that POKE is executed, the Atari's colors will change to the values in the first five bytes, and another interrupt midway down the Graphics 0 instructions (at START+6+15: POKE a 2+128). At that point, the colors will change again.

What you'll have onscreen are the specified colors, changing at the interrupt points to the new colors in COL$.

You're in for a surprise when you push BREAK to halt the program. The screen stays changed! This is because the program and color strings are still in the change of color. (Program 4.) This loads COL$ with our desired 15 color changes, with only the background color changing between each one, at the same lum.

We then call the assembly subroutine, and set our interrupts with another loop:

POKE START,112+128
(blank lines interrupt)

POKE START+3,2+64+128
(lms, gr. 0 interrupt)

FOR D=START+6 to START+6+13
(14 total)

POKE D,2+128
NEXT D

Boom, there you have it, 16 different colors onscreen at once. You'll want to play with this routine and try different luminances for characters, background, border.

One variation on this is to rotate the string once you have the interrupt routine working off it. The effect onscreen is rotating colors, with the shades of color slowly shifting up. This can be done by rotating COL$ five bytes at a time. Add the following lines to Program 4:

500 COL1$=COL$(76,80) (get last five characters)

510 COL1$(6)=COL$(1,75) (append first 75)

520 COL$=COL1$ (and shift it into COL$)

Naturally, if you were mixing graphics modes, as more and more good software is beginning to do, you could just add an interrupt and more colors to shift displayed colors between modes. This can be quite helpful in drawing attention to a certain display. Flashing the display can be accomplished by just rewriting one byte in COL$ to 0, then back; this will change a color register onscreen immediately.

That's the beauty of the routine: all you have to do to modify the colors onscreen is modify the string. (I must give credit where credit is due for the original concept of using strings to manipulate memory to *Creative's* own George Blank. A few columns back he made a player's memory map area be a string, and manipulated the player up and down using string operators. This was a good idea, and this color routine is an offshoot of it.)

Well, on to a demonstration few have seen: 128 shades of color—all on the same screen. The first time I saw this, the person who programmed it dedicated the 6502 processor to updating color registers; it did nothing else. As such it wasn't really useful, but it was a start. Here's my version, which runs along with Basic.

START=PEEK(560)+256*PEEK(561)

START	+0	112	(blank 8 lines) interrupt here required
	+1	112	
	+2	112	
	+3	66	(2, a graphics 0 instruction, + 64=lms)
	+4	data byte	
	+5	data byte	
	+6	2	graphics 0 instructions
	+7	2	
	..		
	+29	2	last graphics 0 instruction

(halt until next refresh).

Table 3. Sample Graphics 0 Display List. (A much expanded version, complete with explanations of the various opcodes, appears in the October issue of *Creative Computing*.)

```
100 REM * PROGRAM 4.
110 REM * 16 COLORS AT THE SAME
    TIME.
120 DIM COL$(255)
130 REM * INITIALIZE COL$ IN GROUPS
140 N=4
150 FOR C=1 TO 80 STEP 5
160 COL$(C)=CHR$(0):REM UNUSED
170 COL$(C+1)=CHR$(0):REM LUM
180 COL$(C+2)=CHR$(N):REM COLOR
190 COL$(C+3)=CHR$(0)
200 COL$(C+4)=CHR$(2):REM GREY
    BORDER
205 N=N+16
210 NEXT C
220 REM
230 REM * NOW CALL DLI HANDLER
240 REM
250 GOSUB 10000
260 REM
270 REM * NOW DO DL WORK
280 START=PEEK(560)+256*PEEK(561)
290 POKE START,112+128
295 POKE START+3,2+64+128
300 REM
310 REM * NOW POKE IN 14 MORE
    (GR/0)
320 REM
330 FOR D=START+6 TO START+6+14
340 POKE D,2+128
350 NEXT D
360 REM
370 REM PROGRAM IS NOW RUNNING.
380 REM
500 STOP
```

Program 4.

Since we can only have 51 interrupts, we can't do it the easiest way, where we shift into Graphics 8 and use 128 interrupts (there are 192 scan lines in Graphics 8). Instead, we will use multiple color registers on the screen side-by-side and shift them four at a time in Graphics 7.

Graphics 7 uses four of the five color registers: 0, 1, 2, and 4 (background).

We generate the four blocks, each using one color register, by a simple nested loop and draw. (See Program 5 and Diagram 5.)

Graphics 7 has 96 display blocks, so let's set a display list interrupt every third block, for 32 total, plus the one at the top of the page for 33. We'll load each color register with a shade of color different from its neighbors just by counting up the 128 possible shades, and offsetting.

Now have a look at Program 5 listing, COL$ initialization. Remember, a change of 2 is required to change one shade of color. We then poke in the DLIs as usual, this time using 13+128 (which is Graphics 7) for 32 of them and the usual one at the top, 112+128.

There you have it, 128 shades of color, all at once. But, I'm not done yet. Let's rotate them.

All we need to do to rotate these colors upwards is shift them up five. The value in color register 4 will be shifted into register 3, and as such become invisible until it is shifted into 2, but no matter. A better routine could bypass the "hole" in the colors.

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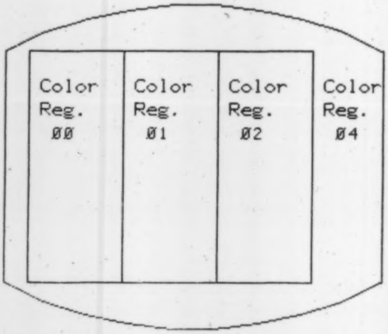
Atari, continued...

Program 5.

```
100 REM PROGRAM 5. 128 SHADES OF COL.
110 DIM COL$(255)
120 REM * DRAW FIGURE
125 GRAPHICS 7+16
126 FOR R=0 TO 4
127 SETCOLOR R,0,R*2
128 NEXT R
129 COLOR 1
130 CL=1
140 FOR X=1 TO 120 STEP 40
150 COLOR CL
160 CL=CL+1
170 FOR Y=1 TO 95
180 PLOT X,Y
190 DRAWTO X+40,Y
200 NEXT Y
210 NEXT X
230 REM * LOAD COLORS
240 CL=0
250 FOR T=1 TO 33*5 STEP 5
260 COL$(T)=CHR$(CL):REM COL REG 0
270 COL$(T+1)=CHR$(CL+64):REM COLREG 1
280 COL$(T+2)=CHR$(CL+128):REM COLREG 2
290 COL$(T+3)=CHR$(CL+192):REM UNUSED
300 COL$(T+4)=CHR$(CL+192):REM COLREG 4
310 CL=CL+2
320 NEXT T
330 REM * CALL DRIVER
340 GOSUB 10000
350 REM * SET INTERRUPTS
360 START=PEEK(560)+256*PEEK(561)
370 POKE START,112+128
380 FOR D=START+7 TO START+7+96 STEP 3
390 POKE D,13+128:REM GR.7
400 NEXT D
410 GOTO 410
```

Diagram 5. In order to get 128 colors onscreen with only 32 total interrupts, we need to change 4 colors per interrupt (i.e., 32 x 4 = 128). We must also display 4 colors per line, which calls for a four color mode: graphics 3, 5, or 7.



Here's a diagram of how the screen is set up in terms of blocks of area of a given color register; this is done with Basic fill routine, but the XIO fill would work equally well.

Add these lines to Program 5 to rotate the colors:

410 COL1$=COL$(6)
420 COL1$(161)=COL$(1,5)
430 COL$=COL1$

This is Program 5 with rotate.

Note that I do string manipulations using a scratch string and only copy it into COL$ when I'm done fiddling with it. This helps prevent the Atari from moving it somewhere with no warning due to changing length, as well as preventing weird screen flickerings, if COL$ should temporarily be too short to provide enough data.

Sunset

By now, if you're running these programs, you're seeing your Atari do things it has never done before. Let me now present to you the Sunset program which is based on a program which appeared previously in this column. It had three spirals, one inside the other. Colors were shifted between them (each spiral was in a different color register, and they were in Graphics 7).

Well, the sneaky idea behind this routine is to use the shifting introduced in the previous program on the spiral routine. The initializations are a bit tricky: each color register is started up a bit offset from the others, so that each will have a considerably different color than the others, and the background is left completely off until halfway down the screen. Then the colors are shifted with the top half of the string being shifted up and the bottom half being shifted down, an effect very much like a sunset over water. I've added a few random stars in the background on the upper half to twinkle as the color registers change. (Program 6.)

Some notes: The Atari variable table can get full of holes, if you do lots of editing, and the Atari has strange cleanup of unused strings. If you start getting unexpected problems, try LISTing the program out to storage then ENTERing it back in; this will clean up the variable table. I've had little problem with this, however.

Conclusion

If you come across a particularly nifty effect, you might mail me a copy at the address appearing at the bottom of the column; I'll try it out and maybe include it in a future column if it's really good.

Be sure to experiment, have fun, and go create something! □

Program 6.

```
100 REM ** PROGRAM 6, SUNSET.
110 REM ***
120 REM *** DAVE SMALL
130 REM ***
140 DIM TOP1$(128),BOT1$(128)
150 DIM TOP$(128),BOT$(128)
160 DIM COL$(255)
170 REM ***********************
180 REM * INITIALIZE SCREEN FOR DISP
190 GOSUB 550
200 REM * INITIALIZE COL $
210 GOSUB 790
220 REM * INITIALIZE ASSEMBLY
230 GOSUB 10000
240 REM ***********************
250 REM * DISPLAY LIST
260 ST=PEEK(560)+256*PEEK(561)
270 POKE ST,112+128:REM TOP INT(15)
280 POKE ST+3,13+64+128:REM LMS,DLI
290 FOR Y=6 TO 6+96 STEP 2:REM HI SRS
300 POKE ST+Y,13+128
310 NEXT Y
320 REM ***********************
330 REM ROTATE COL$ IN HALVES
340 FOR ROT=0 TO 300 STEP 2
350 SANDY=0
360 BOT$=COL$(1,125)
370 TOP$=COL$(126,250)
380 REM **
390 TOP1$=TOP$(1,120)
400 TOP$=TOP$(121,125)
410 TOP$(6)=TOP1$
420 TOP$(5,5)=CHR$(ROT)
426 IF ROT>255 THEN TOP$(5,5)=CHR$(0)
430 REM
440 BOT1$=BOT$(1,5)
450 BOT$=BOT$(6)
460 BOT$(121)=BOT1$
470 REM
480 COL$(1,125)=BOT$
490 COL$(126)=TOP$
500 NEXT ROT
510 GOTO 340
530 REM *************************
540 REM FROM CREATIVE COMPUTING..
550 GRAPHICS 23:DEG :SETCOLOR
    2,4,10:DIM C(3)
560 SETCOLOR 0,0,10
570 SETCOLOR 1,0,6
580 SETCOLOR 2,0,2
590 R=20:COLOR 1:C=1
600 X0=79:Y0=47
610 FOR K=0 TO 3:C(K)=K+1*2:NEXT K
620 FOR K=1 TO 3
630 X=X0+R*COS(360):Y=Y0:PLOT X,Y
640 FOR I=0 TO 5*360 STEP 75
650 X-X0+R*COS(I):Y-Y0+R*SIN(I)
660 DRAWTO X,Y
670 NEXT I:R=R+12:C=C+1:COLOR C
680 NEXT K
690 Z8=1
700 FOR LOOP=1 TO 50
710 COLOR Z8
720 X8=INT(RND(0)*159)+1
730 Y8=INT(RND(0)*47)+1
740 PLOT X8,Y8
750 Z8=Z8+1:IF Z8=4 THEN Z8=1
760 NEXT LOOP
770 RETURN
780 REM *************************
790 REM *** INIT COL$
800 FOR T=1 TO 255 STEP 5
810 COL$(T,T)=CHR$(T)
820 T1=T+80
830 T2=T+160
840 IF T1>255 THEN T1=T1-256
850 IF T2>255 THEN T2=T2-256
860 COL$(T+1,T+1)=CHR$(T1)
870 COL$(T+2,T+2)=CHR$(T2)
880 COL$(T+3,T+3)=CHR$(0)
890 COL$(T+4,T+4)=CHR$(0)
900 NEXT T
910 RETURN
```

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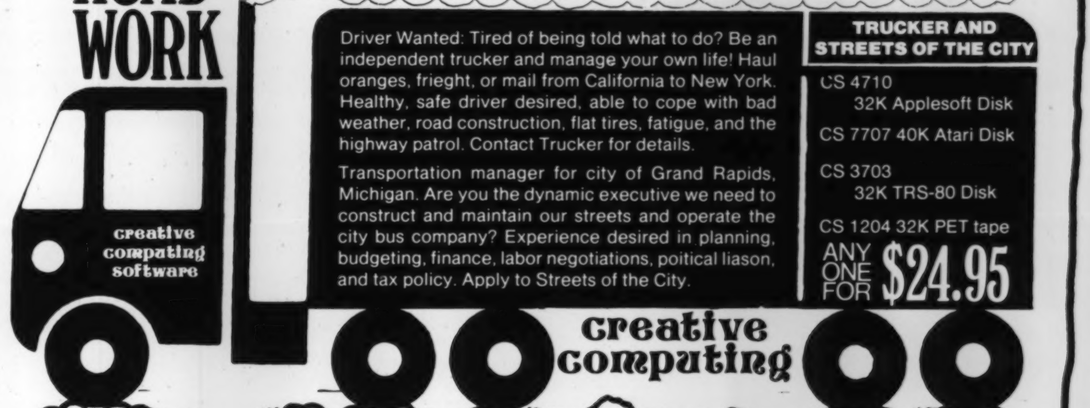

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Chuck Carpenter

Back in the May '81 issue, there was some discussion of limited memory space with hi-res graphics. Several readers sent me their techniques for handling the problem. Some of the techniques will be included in this column. And, we'll get into the specifics of the whats and whys for doing it. Also, several readers sent in some one-liner programs. Those will be included in this column, too. Since it's Christmas time again you may be looking for things to use with your Apple II. Several Apple-only books are included here with a brief discussion of the contents.

MISSING INFO

CP/M for the Apple was reviewed here in the Sept '81 issue. On page 146, in the paragraph titled *Documentation* I mentioned several sources of information. I said I would cover them later. Well, this is later! Actually, the intention was to include the info with the review. But...Anyway, here it is now.

Probably the most useful book you can get is the *CP/M Primer* by Mitchell Waite and Stephen Murtha (see photo). Most of the functions of the CP/M operating system are simply and effectively described. The Primer is a must for CP/M beginners. Then there's *The CP/M Handbook* by Rodnay Zaks and *CP/M Users Guide* by Thom Hogan. These are two very thorough books for the more advanced CP/M user. You can find these books at many computer stores or look for them in the magazine ads. Here's a list of the books and their publishers.

CP/M Primer
Howard W. Sam & Co., Inc.
4300 West 62nd St.
Indianapolis, IN 46268

CP/M Handbook
Sybex
2344 Sixth St.
Berkeley, CA 94710

CP/M Users Guide
Osborne/McGraw-Hill
630 Bancroft Way, Dept. L-13
Berkeley, CA 94710

Chuck Carpenter, 2228 Montclair Pl., Carrollton, TX 75007.

The 8 1/2 x 11 size CP/M Primer and the half-page size Volume 1 of the Microsoft documentation.

HI-RES MEMORY

In the April '81 column, was included a brief discussion of hi-res memory usage. The intent of that article was to illustrate why less memory is available to Applesoft programmers than to Apple Integer programmers. Since no attempt was made to show how to work around limited memory, several readers sent in a variety of solutions. We'll get to them but first some background.

Pointers and Things

In order for the Basic interpreter to know the size of a program, memory locations are used to contain various program addresses. These are called pointers (also pointer registers). Pointers contain the addresses for the beginning of the program, the end of the program, the end of variable tables and more. You can find the pointer data listed on pages 140 and 141 of your *Apple II Reference Manual*. These pages refer to zero page usage. It is conventional with 6502 programs to put often-used data in page 0. When this is done, machine language programs run faster. On page 140 you will find that the beginning of a program is stored at hex addresses $67 and $68 (decimal 103 and 104). Note that the $ symbol is used to show hexadecimal numbers in the 6502 microprocessor system.

Normally the values stored at these addresses are 01 and 08. They represent the hex address $0801. If you want to move the beginning of a Basic program, just change the programs to make more room. As I mentioned earlier, several readers contributed their techniques. They range from the uncomplicated to the sophisticated. Let's look at some examples.

The Uncomplicated

First, determine if you are going to use one or two hi-res pages. Next, POKE the new beginning-of-program pointers into memory locations 103 and 104. Now, to finish, POKE a zero into the memory location preceding the address used above. It will look something like this:

```
  POKE 103,LOMEM LOBYTE+1
  POKE 104,LOMEM HIBYTE
  POKE LOMEM,0
```

If you wanted to set LOMEM and the program pointers to the top of hi-res page 2, do this:

```
  POKE 103,1
  POKE 104,96
  POKE 24576,0
```

To set LOMEM to the top of hi-res page 1, use these POKEs:

```
  POKE 103,1
  POKE 104,64
  POKE 16384,0
```

Going back to the start can be accomplished by typing TEXT then INT or FP. Use the one corresponding to the version of Basic you're using. Pressing RESET will work too. Be careful you don't lose your program.

Note the third POKE in the examples. This is done to tell Applesoft where the beginning of program space is. This version

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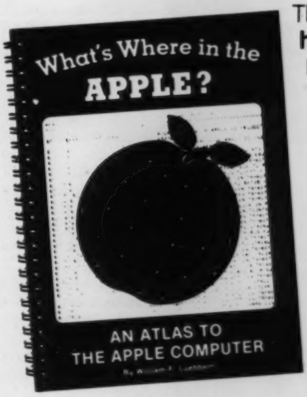

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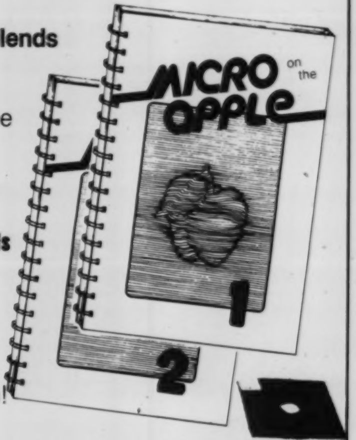

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D

Apple Cart, continued...

of Basic, a dialect of Microsoft Basic, puts a zero at the beginning of program space. The next byte is the first byte of the program. It is also the first byte of the address of the next line in the program.

Several readers contributed similar info on this technique. They are: William J. Edmunds, Herbert McKinstry, Charles Kluepfel, Steven Kahn, John Bury, James F. Johnson, and Henry Hwong. (In no particular order.)

The Sophisticated

Using the POKE method is effective. But, the power of your computer is not being used to advantage. A more automated way was also contributed by William J. Edmunds. Listing 1 is his program to set the memory locations as required. William sez, "I've included a listing of a short program I am working on. With some modification, I can use it as a loader for

```
10  TEXT : HOME
15  VTAB 3: HTAB 13
20  PRINT "LOMEM MODIFIER"
21  PRINT : PRINT "1. 16,384 OR $4000": PRINT "2. 24,576 OR $6000"
22  PRINT "3. 28,672 OR $7000": PRINT "4. ANOTHER LOCATION"
24  VTAB 10: PRINT "  WHERE DO YOU WANT LOMEM SET ";: GET A$
25  IF A$ = "1" THEN LO = 16384: GOTO 50
26  IF A$ = "2" THEN LO = 24576: GOTO 50
27  IF A$ = "3" THEN LO = 28672: GOTO 50
30  VTAB 10: PRINT "   WHERE DO YOU WANT LOMEM SET ";: INPUT A$
40  LET LO =  VAL (A$): IF LO < 2048 OR LO > 4900 THEN  HOME : GOTO 30
50  LET LO = LO + 1
100  LET I =  INT (LO / 256)
110  LET R = LO - I * 256
120  POKE 103,R
130  POKE 104,I
140  POKE LO - 1,0
200  HOME : VTAB 10
210  PRINT "LOMEM IS SET TO ";LO - 1
220  PRINT : PRINT "LOAD YOUR PROGRAM"
300  NEW
```

Listing 1. Program to POKE LOMEM for use with graphics programs.

```
10  REM  - BY: SHAUN HOPE,
               NORTHANTS, ENGLAND

20  GR : HOME :U = 1:S = 16:T = 2
     :E = 39:F = 40:Z = 0:C =  RND
     (1) * 15 + 1: FOR N = 0 TO 1
     00 STEP .015: COLOR= C:M =  ABS
     ( INT ( SIN (N) ^ T * F)):Q =
     Q + U - F * (Q = E):C = C *
     (Q > Z) + (Q = Z) *  RND (U)
      * S:X = E - Q:Y = E - M: PLOT
     M,Q: PLOT Q,M: PLOT X,Y: PLOT
     Y,X: PLOT M,X: PLOT X,M: PLOT
     Y,Q: PLOT Q,Y: NEXT : RUN
```

Listing 2. Lo-res routine to draw a pattern on the screen. Unique use of logic avoids use of IF-THEN statements.

```
10  REM  - BY: BOB WONG
                BROOKLYN, NY
20 C = 139:D = 95: HGR : POKE  -
     16302,0: FOR Z = 1 TO 5000: FOR
     Y = 1 TO 50:E =  RND (1) * 7
     :A =  RND (1) * 269 + 10:B =
      RND (1) * 181 + 10: HCOLOR=
     E: HPLOT C,D TO A,B:S =  PEEK
     ( - 16336): NEXT :D = B:C =
     A: CALL  - 3082: NEXT : TEXT
     : END
```

Listing 3. Hi-res routine draws a pattern of lines in a variety of colors.

```
10  REM  - BY: SKENE MOODY
               SAN MARINO, CA
20  FOR N = 0 TO 49: HOME : VTAB
     24: HTAB 20: PRINT "N= ";N: HGR
     : HCOLOR= 3: HPLOT 279,79: FOR
     I = 0 TO 6.28318531 STEP .06
     28318531: HPLOT  TO  COS (I)
      * 139 + 140, SIN (N * I) *
     79 + 79: NEXT : NEXT : TEXT
     : HOME : LIST
```

Listing 4. Hi-res routine produces lissajous figures. These figures will be familiar to long-time oscilloscope users.

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completed programs that won't fit below the hi-res page.

"Option (1) will set lo-mem above hi-res page 1, option (2) above hi-res page 2, and option (3) above $7000. I use (3) for disk based Applesoft and the hi-res character generator available from Apple's contributed software bank. Option (4) lets you set lo-mem wherever you like, within reason.

"Back before I learned to do this, I struggled with disk-based Applesoft and hi-res page 2 (trying to keep my programs under 4K). This program really opened things up for me and is just as useful now that I have a RAM card."

William's program will be a help to those of you just starting with hi-res graphics and Applesoft. You can run this program as a boot program. Or, use it as-is each time your want to use hi-res graphics. A similar suggestion was made to do the task with an EXEC file. In *Call Apple* and *Nibble* magazines there have been ways shown to link the low side of the graphics pages to the high side. There are lots of ideas and ways to solve hi-res problems. Experiment and find as many as you can.

ONE-LINERS

In the June '81 column I used a couple of one-liner programs. In response to a request for more, three readers replied. Listings 2, 3 and 4 are the resulting programs.

Listing 2 includes a lo-res program from Shaun Hope. This program uses logic in place of IF...THEN statements. As Shaun points out, "IF...THEN statements cannot be used in a one-liner. This makes a useful exercise in the use of logical statements. For instance:

```
   Q = Q + 1 : IF Q = 40 THEN Q = 0 :
COLOR = RND(1) * 16:
```

Applesoft would skip to the next line (which we don't have in a one-liner) if the IF condition were false. Integer Basic would go on to the COLOR statement regardless.

The only way to get around this in a one-liner is to use two logical statements:

```
   Q = Q + 1 - 40 * (Q = 39) : C = C * (Q
   0) + (Q = 0) * RND(1) * 16 :
```

Notice the INT function is not necesssary on COLOR statements, and that variables are used (in the program) in an attempt to make the program a little faster."

Try Shaun's program with your color TV. You will see some interesting patterns.

Another program comes from Bob Wong. The program in Listing 3 is a hi-res graphics program. The program draws a pattern of lines in several colors.

Listing 4, a hi-res program from Skene Moody, produces some interesting patterns. Those of you who have worked with oscilloscopes will recognize the familiar lissajous figures. The vertical frequency is always 1 and the horizontal frequency changes from 1 to 49. Near the end of the range the figures look like amplitude modulated frequencies. (Or, something like a two-tone modulated transmitter output.)

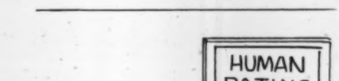
Type these one-line programs carefully. I have to do some of them over several times. It's easy to leave out part of one line. What interesting variations can you think of? Send your ideas and programs and they will be included in a future column.

BOOKS TO BUY

Books written especially for use with the Apple became more available this past year. Here's a list of some of the ones I have.

About Machine Language

Apple Machine Language, by Don and Kurt Inman, Reston Publishing Co., Inc., Reston, VA 22090.



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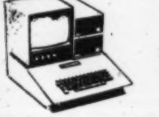

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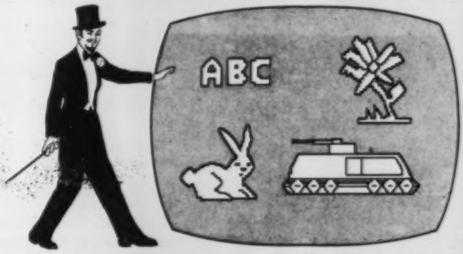

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Apple Cart, continued...

Twelve chapters integrate machine language with Basic and the Apple Mini-assembler. Chapters 1 to 7 review Basic and develop a Basic Operating System (BOS). The BOS is used to develop machine language programs. These programs do simple graphics, display text, and generate sounds. Chapter 7 combines sound with graphics.

Chapters 8, 9 and 10 explain some of the Apple System Monitor (SM). Most of these chapters deal with arithmetic processing. That's a shame because there are lots of things happening in the monitor besides mathematics. However, it is true that all the monitor functions are mathematical in nature. Some discussion of these functions in non-mathematical terms would have made learning about the monitor more friendly.

Apple's Mini-assembler is discussed in chapter 11. The mini-asembler is used to describe several of the 6502 indexing modes. One problem I see here is that the Apple II Plus machines don't have a mini-assembler. My Oct. '81 column described how to have the mini-assembler on any machine. So, if you want to do things described in the book, you can.

Chapter 12 is called "Putting It all Together." This chapter combines Basic, BOS, SM, and the mini-assembler.

Each chapter includes a summary, exercises, and answers to the exercises. The Appendix includes a section on Basic statements, Machine language instructions, built-in subroutines, and display symbols (prompts). Also included in the appendix are hex equivalents, video memory data, and the 6502 instruction codes. This is a good book for anyone interested in Apple machine language. There are some shortcomings. But, once this book is learned, it's easy to continue on with machine language.

About DOS

Looking for a book that will completely describe the Apple Disk Operating System? Here's one that will.

Beneath Apple DOS, by Don Worth and Pieter Lechner, Quality Software, 6660 Reseda Blvd., Suite 105, Reseda, CA 91335 (213) 244-6599.

This book is more for those in the advanced programming category. Don't overlook it as a source of information while you're learning though. It's a lot like learning algebra. You don't know why you're doing it until you take calculus.

Beneath Apple DOS is divided into 8 chapters and 3 appendices. The first two chapters are introductory; no real meat here. Chapter 3 discusses diskette formatting. Chapter 4 begins to tell you about the DOS details. In chapter 5, the structure of DOS is discussed. Using DOS from assembly language is included in chapter 6 and chapter 7 tells you how to customize DOS. DOS program logic is included in chapter 8. The appendices include example programs in appendix A, disk protection schemes in B and a Glossary in appendix B.

About Everything

There are a couple of books available that do just about that: tell you most everything. One of them is called the *Apple II User's Guide*. The other is called *Programmers Handbook to the Apple II.*

Apple II User's Guide, by Lon Poole with Martin McNiff and Steven Cook, 630 Bancroft Way, Berkeley, CA 94701.

Eight chapters and 12 sections to the Appendix make this a useful beginner's book. From introductory chapter 1 to the compendium of statements in chapter 8, this book covers the fundamentals of operating your Apple II. In chapter 2 you learn how to operate the Apple II. Chapter 3 begins the fundamentals of programming in Basic, with advanced Basic in chapter 4. Information about the disk is covered in chapter 5 and Graphics and Sound are included in chapter 6. Chapter 7 provides the beginner with some exposure to the Machine Language Monitor. The appendices include such extras as Useful PEEKS and POKES, Memory Usage, and ASCII Character Codes and Applesoft Reserved Word Tokens.

Generally, the book provides useful information to the newcomer. There are some problems though. For instance, on page 156 there is a table of Applesoft Basic Immediate Mode commands. These are actually deferred (or programmed) mode commands. As with anything you read use the contents as information-only until you can verify the accuracy. The book is well done otherwise and will be an asset to the beginners library.

Programmer's Handbook to the Apple II, Computer Station, Inc., 11610 Page Service Dr., St. Louis, MO 63141. (314) 432-7019.

This *Handbook* is a huge extension to Computer Station's Programmers Guide. There are 15 sections covering everything from the Monitor to References. This book is a compendium of the commands for most of the major programs used with the Apple II. Once you have learned the basics of a particular program, you can find the essence of the commands and statements in the *Handbook*. Included are the Basics, Pascal, Visicalc, and CP/M with Basic-80. This book is a useful reference to many of the programs used on the Apple II. ☐

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Why would anyone spend $59.95 for a joystick?

Super Joystick

Star Wars. Played with paddles, it's difficult at best and frustrating at worst. But with a joystick it becomes an entirely new experience. It's still challenging. It's also fun. And very addictive.

Have you ever used a drawing program in which one paddle controls the horizontal movement of the "brush" and the other paddle the vertical? It's slow, tedious work. But with a joystick, drawing is an absolute joy.

Exceptional Precision

The Apple high-resolution screen is divided into a matrix of 160 by 280 pixels. To do precise work on this screen, you need a precise device. Most potentiometers used in paddle controls are not quite linear. If you rotate a paddle control at a constant speed, you'll notice that the cursor speeds up slightly at the beginning and end of the paddle rotation.

The Super Joystick has a pure resistive circuit which is absolutely linear within one tenth of one percent. In other words it would give you precise control over an image of 1000 by 1000 pixels, were such resolution available. Thus it is suitable for high precision professional applications as well as educational and hobbyist ones.

Matched to your application

The Super Joystick also has two external trim adjustments, one for each direction. This allows you to perfectly match the unit to your application and computer. Say you want to work in a square area instead of the rectangular screen. Just reduce the horizontal size with the trim control.

How many times have you played Space Invader and had your thumb ache for hours from the repeated button pressing? This won't happen with the Super Joystick. It's two pushbuttons are big. Moreover, they use massive contact surfaces with a life of well over 1,000,000 contacts. A few games of Super Invader using these big buttons will justify the purchase of the Super Joystick.

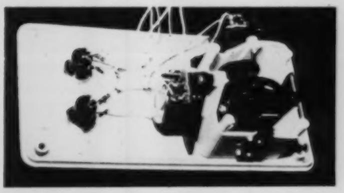
The Super Joystick is self-centering in both directions. That means when you take your hand off it, the control will return to the center. However, if you want it to stay where you leave it, self-centering may be easily disabled.

The Super Joystick plugs right into the paddle control socket and doesn't require an I/O slot.

High-quality construction

The sturdy high-impact molded plastic case of the Super Joystick matches that of the Apple computer. Every component used is the very highest quality available.

We invite your comparison of the Super Joystick with any other unit available. Order it and use it for 30 days. If you're not completely satisfied, return it for a prompt and courteous refund plus your return postage. You can't lose.



By removing two springs, self-centering can be defeated.

The Super Joystick consists of a self-centering, linear joystick, two trim controls, and two pushbuttons mounted in an attractive case. It comes complete with instructions and a 90-day limited warranty. Cost is $59.95.

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rings...trs-80 strings...trs-8

Stephen B. Gray

At the 35th tick of the TRS-80 clock, it's time to look at the latest price of the Pocket Computer, a program that lets you create your own dungeons, a new publication featuring software reviews, three of the new engineering programs from Sams, three keyboard utilities that can save you much programming time, a multi-function utility, and a short program by Leo Christopherson that creates fine computer art.

If this seems like a large number of software reviews, I'm trying to catch up on them so I can get back to showing you how to do some nice things with graphics.

Pocket Computer: $229.95

When the August column (p. 188) reported the May sale price of $199 for the Pocket Computer, that price seemed like it might just stay put, because of competition from the Sharp PC-1211 look-alike.

However, Radio Shack meant it when they said this was a sale price. Recent ads and the latest catalog (RSC-6) all list the Pocket Computer at $229.95, where it's likely to stay for a long time.

Create Your Own Dungeons

Treasure Dungeon 2 is an adventure game for 16K Level-II TRS-80, available at $9.95 on cassette from SoftSide (6 South St., Milford, NH 03055).

As usual in such adventures, you explore a dungeon of rooms and passages, kill monsters (orcs, minotaurs, etc.) and usually gain treasure thereby, or get killed. You move in the four cardinal directions, and at any time can query for a report on your current status.

Some "solid" walls have secret doors, some doors offer one-way passage only, and a hidden trap can drop you into a new room. When you find and defeat all the monsters (typically, 13 monsters amid 75 rooms), the game is over.

I got an OM error when I tried to run this on a 16K machine. The solution was to change the CLEAR statement in line 105 from 500 to 400. Also, delete line 9280, or you'll get an L3 error message.

What makes this game unique is that you can use it to create your own dungeons. For example, look at the DATA lines in the program. Four lines of string data describe the dungeon, followed by the number of rooms, monsters and treasures.

The program is designed in top-down fashion. All major program blocks (wall, door, move, room display, monster, etc.) have clearly defined instructions and are accessed as subroutines using GOSUBs.

The basic program and the particular adventure are independent entities. The program provides a structure that can run any number of dungeon adventures, each of which is represented entirely by data stored as DATA statements. An entirely different adventure can be created by changing these DATA statements. Or a different dungeon description can be stored on tape or disk, and a short subroutine can read the data from there.

Happy dungeoning!

Software Critic

The first issue of *Software Critic*, for May-June 1981, has been published, at $15 a year for six issues, by Software Critic (Box 3CH, University Park, NM 88003).

The 24-page first issue carries reviews of ten TRS-80 programs, including VisiCalc ("a bit on the expensive side...very powerful and useful system...documentation extremely well done"), SubLogic's T80-FS1 flight simulator ("Either the lack of TRS-80 graphics resolution or the program's inability to use it effectively makes the displays, other than the radar view, almost useless"), Radio Shack's Dancing Demon ("great entertainment value...allows some realistic tests of choreography"), and Computer Information Exchange's Tiny Payroll ("cannot in good conscience recommend") and Tape #8 of 39 programs ("some good, some excellent, some downright boring...you can't beat CIE's prices").

The reviews range in length from two-thirds of a page for Tiny Payroll to 3 1/2 pages for the Cornsoft Group's ENHBAS. A dozen screen prints illustrate four of the programs.

The 24 pages include 18 1/4 for reviews, 2 3/4 of various comments, one for contents, two for covers. A matrix printer was used; a Diablo printer is included in "not so distant future" plans.

The publisher is Timothy J. Pettibone, a professor of education management and development at New Mexico State U., who specializes in computer applications in education.

Critique. This is for the person who buys a lot of software. The reviews are detailed, informal, and seem well worth the $2.50 a copy...if you're really into software packages.

Sams Software

Howard W. Sams & Co., the technical-book company we've all known for years, has branched out into computer software, with programs in Basic for the TRS-80, Apple II and OSI machines.

The initial offering consists of seven software packages, each with three to eight programs for circuit design and analysis, curve-plotting, statistical analysis, or advanced math.

Sams is making a major software effort, so the software group has already had its name changed from Software Operating Systems to Advanced Operating Systems, made into a separate company, moved to Michigan City, and will also be going into advanced games, utilities, and eventually into business programs.

Let's look at three of the seven packages, all available in computer stores for the Model I Level II TRS-80, on tape for $24.95 or disk for $29.95. Or, with a $2 charge per order for handling, from Advanced Operating Systems, 450 St. John Rd., Michigan City, IN 46360.

Each package includes an explanatory booklet that shows how to use the programs. The package is curious: it's wrapped in plastic, displaying the booklet, which has a title and list of contents on the cover. Remove the plastic and the booklet, you find a cardboard box with the cassette inserted in a cutout in the box. The only

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INSTANT ASSEMBLER

The **INSTANT ASSEMBLER** is a new, powerful tape-based assembler and debugger for the TRS-80. Now you can assemble directly to memory and immediately debug your program with the built in single stepping debugger. Quickly switch from assembler to debugger and back again without losing the source code. This feature makes INSTANT ASSEMBLER an excellent learning tool for assembly language programming.
INSTANT ASSEMBLER is absolutely unique among tape based assemblers in that it produces relocatable code modules that can be linked with the separate LINKING LOADER, which is supplied in two versions for loading programs into either high or low RAM. This lets you build long programs with small modules. INSTANT ASSEMBLER also features immediate detection of errors as the source code is entered, a compactly coded source format that uses 1/3 as much memory as standard source, and many operational features including single stroke entry of DEFB and DEFW, pinpoint control of listings, alphabetic listing of symbol table, separate commands for listing error lines or the symbol table, block move function, and verification of source tapes.
INSTANT ASSEMBLER's debugger provides single stepping with full register displays, decimal or hex entry of addresses, forward or backward memory displays, disassembly of object code in memory, memory display in ASCII format, and hex-to-decimal or decimal-to-hex conversion. The single-stepper will step one instruction at a time or at a fast rate to any defined address.
INSTANT ASSEMBLER occupies less than 8400 bytes of memory. In a 16K machine this will leave you enough memory to write assembly language programs of around 2000 bytes. This and its module-linking feature make INSTANT ASSEMBLER ideal for users with only 16K machines. The instruction manual may be purchased separately for $3, which will apply towards the purchase of the INSTANT ASSEMBLER.
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STEP80 allows you to step through any machine language program one instruction at a time, and see the address, hexadecimal value, Zilog mnemonic, register contents, and step count for each instruction. The top 14 lines of the video screen are left unaltered so that the 'target program' may perform its display functions unobstructed. STEP80 will follow program flow right into the ROMs, and is an invaluable aid in learning how the ROM routines function. Commands include step (trace), disassemble, run in step mode at variable step rate, display or alter memory or CPU registers, jump to memory location, execute a CALL, set breakpoints in RAM or ROM, write SYSTEM tapes, and relocate to any page in RAM. The display may also be routed to your line printer through the device control block so custom print drivers are automatically supported.
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This machine language program may be used as a smart terminal with time share systems or for high speed file transfers between two disk-based micros over modems or direct wire. It is menu driven and extremely simple to use. Functions include real-time terminal mode, save RAM buffer on disk, transmit disk file, receive binary files, examine and modify UART parameters, program 8 custom log-on messages, automatic 16-bit checksum verification of accurate transmission and reception, and many more user conveniences. Supports line printers and lowercase characters. With this program you will no longer need to convert machine language programs to ASCII for transmission, and you will know immediately if the transmission was accurate. This program comes on a formatted disk.
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PROGRAM INDEX VERSION 2.0

Assemble an alphabetized index of your entire program library from disk directories. Program names and free space are read automatically (need not be typed in) and may be alphabetized by disk or program. The list may also be searched for any disk, program, or extension; disks or programs added or deleted; and the whole list or any part sent to the printer. Printer output may be requested in three different formats including labels. The list itself may also be stored on disk for future access and update. It also includes a PURGE mode for quickly killing unwanted files. Directory reads and alphabetizing is done in machine code for speed. 1,000 programs may be sorted in less than 10 seconds. Works with TRSDOS, NEWDOS, and NEWDOS/80 single or double density. One drive and 32K required.
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way you can store the package is to put the booklet in the box, and then put the cassette on the side of the booklet facing away from the cutout. Only by putting the booklet upside down will you be able to read the title through the cutout. Later editions, hopefully, will improve on this.

On each box the package is defined as "Circuit design programs to let you spend less time on routine calculations, statics, and analysis...more time on creative design and engineering."

Displaying Graphs

Five programs are on a tape called Plotting Graphs for Video Display: histogram cartesian, semi-log, log-log, and polar plots. The first four are subroutines, needing simple driver programs that call them with a GOSUB. Apparently a universal program for any of these four would be either too cumbersome, from having to take into account all the possible types of input data, or just plain impossible.

Sample driver programs are provided for these four, such as, for the first, a program and data involving the mmeasurement of values of a sample batch of resistors.

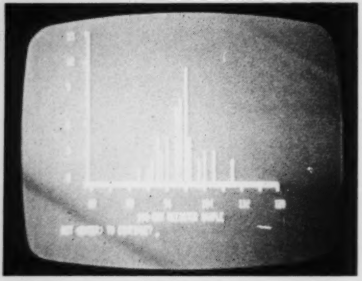


Figure 1.

Once the plot is made, you can change the scale factors, and the histogram is then redrawn automatically, using the same data, to give you a different perspective on the frequency distribution.

The polar plot is a stand-alone program, asking only that you enter a polar function in line 152, or discrete data points, plus title, plot increment in degrees, and maximum radius.

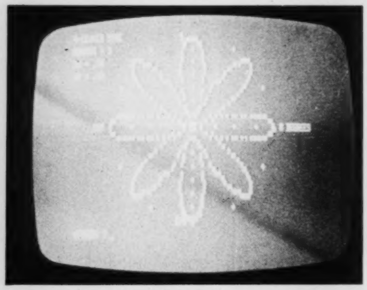
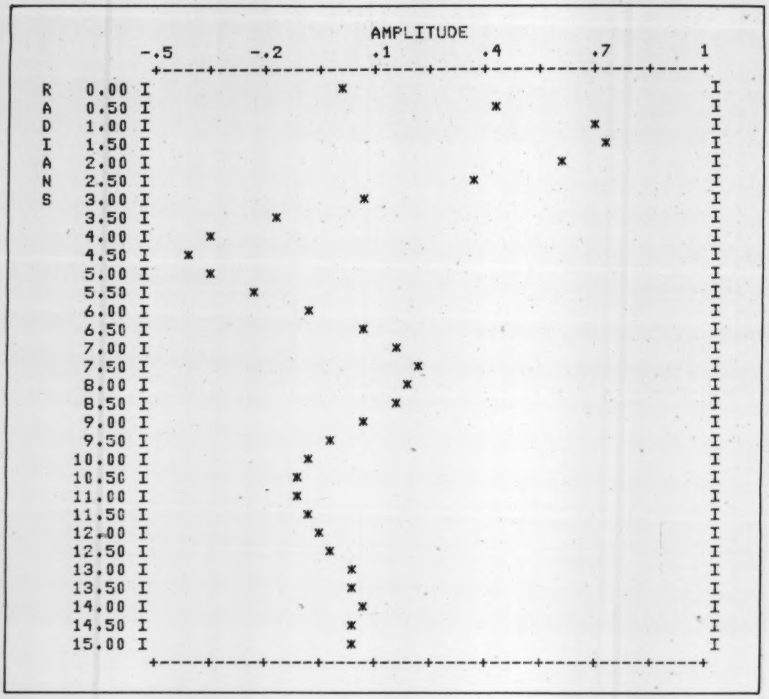


Figure 2.

Several common polar functions are provided, along with video plots, to show what to expect.



```
                              AMPLITUDE
         -.5       -.2        .1        .4        .7        1
          +----+----+----+----+----+----+----+----+----+----+
R   0.00 I                 *                                 I
A   0.50 I                               *                   I
D   1.00 I                                        *          I
I   1.50 I                                         *         I
A   2.00 I                                     *             I
N   2.50 I                             *                     I
S   3.00 I                   *                               I
    3.50 I           *                                       I
    4.00 I     *                                             I
    4.50 I   *                                               I
    5.00 I     *                                             I
    5.50 I         *                                         I
    6.00 I              *                                    I
    6.50 I                   *                               I
    7.00 I                      *                            I
    7.50 I                        *                          I
    8.00 I                       *                           I
    8.50 I                      *                            I
    9.00 I                   *                               I
    9.50 I                *                                  I
   10.00 I              *                                    I
   10.50 I             *                                     I
   11.00 I             *                                     I
   11.50 I              *                                    I
   12.00 I               *                                   I
   12.50 I                *                                  I
   13.00 I                  *                                I
   13.50 I                  *                                I
   14.00 I                   *                               I
   14.50 I                  *                                I
   15.00 I                  *                                I
          +----+----+----+----+----+----+----+----+----+----+
```

Figure 3

Printing Graphs

Three programs are provided in Plotting Graphs for Line Printer: cartesian, semi-log, and polar plots. The programs are all based on LPRINT statements, so they print out, but don't display plots on the screen. If there were some way to alternate between PRINT and LPRINT statements, these two packages for displaying and for printing graphs could be combined into one. For one thing, it would be nice to be able to preview a plot on the screen, before printing it, which would save time and paper.

The three printing programs are stand-alone types, with which you simply enter the requested function and scalar data. The accompanying booklet is minimal, because the programs guide the user through all the necessary steps.

Electronics II

Seven programs comprise the Electronics II package, including a four-quadrant arctangent function, rectangular/polar conversion and complex-number mathematics, minimum and maximum values of an array, and inverse Laplace transforms of a transfer function.

Two of the seven (arctangent, array) are subroutines, needing program drivers. The rest are stand-alone programs that guide the user. The 16-page booklet is the most elaborate of the three seen.

The four other software packages in this initial offering are: active filter design (six programs), descriptive statistics and regression analysis (three programs), Electronics, I (five programs, including timer design and heat-sink selection and design), and Electronics III (eight programs, including delta-wye transforms and attenuator-pad design).

The 15 programs in the three packages reviewed are straightforward and require a minimum of fuss to use, although they seem rather expensive. Perhaps Sams felt that companies rather than individuals would be buying them, and thus could more easily afford them.

Basic Shorthand

If you write or copy a lot of programs, you can cut your time by up to 50 percent, and increase your accuracy, by using TSHORT+, a machine-language utility from WEB International (Box 96 DM, Corona Del Mar, CA 92625). For $19.95 you get a cassette with a 16K Level II version on one side, single-drive DOS on the other; for $24.95, a formatted diskette for DOS with two or more drives.

The original TSHORT, which is still available, displays 32 commands by pressing SHIFT and a single key for each, and

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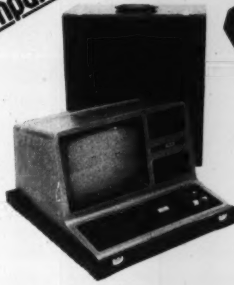

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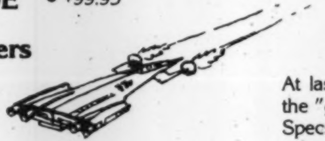

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provides one key for a user-defined instruction up to 64 characters long.

TSHORT+, which resides in only 580 bytes of low memory, has 41 preprogrammed Level II and DOS statement keys, and 11 custom keys: 10 that can be programmed up to 10 characters each, and one programmable up to 64. (Microsoft's Level III Basic (Apr. 1981, p. 188) has 26 abbreviated-entry keys.)

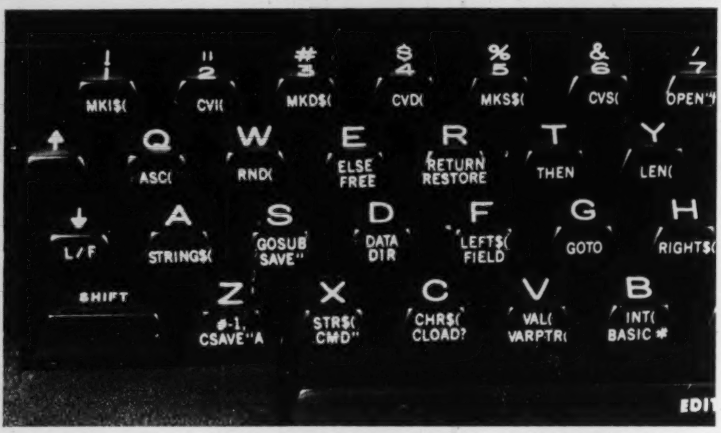

Figure 4.

Some of the keys show two statements. One is obtained by first pressing SHIFT, the other by first using CLEAR. For example, press CLEAR and the F, and the screen displays

FIELD

or press SHIFT and F, and the display is

LEFT$(

which saves you three or four keystrokes each, even more on statements such as VARPTR(and STRING$(.

Other TSHORT+ features include automatic keyboard debounce, a lower-case driver, a programmable pause in custom keys to allow an automatic close-parenthesis after keyboard entries, and four keys that auto-repeat when held down for half a second: SPACE, BACKSPACE, UP-ARROW and DOWN-ARROW.

To program the custom keys, press both CLEAR and SHIFT, then a key from 0 to 9, and you're ready to enter characters. The K key is the one that allows up to 64 characters to be entered. To call up any of these 11 custom statements, just press CLEAR and keys 0-9 or K. If you don't program any of the 10 regular custom keys, they'll call up 10 pre-programmed statements.

Decals are provided, as the photo shows. This will be a problem if you've already installed the Scripsit press-on key labels, although the four-page TSHORT+ manual suggests putting the decals "slightly below the Scripsit words."

The manual notes that "Other 'system' programs having to do with the keyboard and its functions, including debounce, lower-case drivers, auto repeaters, editors, M/L word processors, etc., should not expect to operate with with TSHORT+. High-memory printer drivers, provided they don't include debounce, should work fine TSHORT+."

Send for the WEB catalog. They have beepers that can be programmed to blip every time you press a key, a solenoid kit that drives a Selectric with your TRS-80, a controller/formatter to connect an IBM 50, 60 or 70 electronic typewriter to your TRS-80, a small buffer to reduce the current passes through the TRS-80's reed relay to keep the points from welding together, a database manager, a real-time clock, and other goodies.

IRV

A machine-language utility, IRV is similar to TSHORT+, and is available from The Programmer's Guild (Box 66, Peterboro, NH 03458) or TSE/Hardside, as a Level II 16K cassette for $24.95 or disk for $29.95.

IRV costs more than TSHORT+, and does more. For instance, *any* key will auto-repeat if held down for over a second.

The 26 alphabet keys plus three others, provide a total of 29 statements that can be displayed with a single keystroke plus SHIFT. Any of the 29, which include DATA, STRING$(and CLOAD, may be "reprogrammed to simulate any keyboard input," as the five-page manual puts it. The maximum number of characters the reprogrammed 29 can hold, altogether, seems to be over 200. Thus four keys can be reprogrammed to hold about 50 characters each, ten keys to hold about 20 each, etc.

No decals are included, but for $5, WEB International can provide a set of "original TSHORT decals"; the WEB catalog says "85% of TSHORT's statement keys match those preprogrammed in IRV."

Line editing is made very easy with IRV. List a line, depress SHIFT/BREAK, then use the arrow keys to locate any character (including line numbers) you want to change, and just type over it and press ENTER. Renumbered lines are located. The CLEAR key deletes a character and closes the line; BREAK does the opposite by inserting a blank. The auto-repeat feature can be used to move the cursor, also to delete and insert. The line editor can also be used to enter graphics characters into strings.

No need to unplug the cassette remote plug for a fast forward or rewind; just hit SHIFT and CLEAR to turn on the cassette recorder's motor, or to turn it off later.

Keyplus

A third multifunction keyboard utility is Keyplus, from SJW Inc. (Box 438, Huntington Valley, PA 19006). This ingenious Level II machine-language program is $14.95 on cassette (16K), $19.95 on disk (32K or 48K).

Most of the Keyplus functions can be turned on or off, as desired, including auto-repeat of any key (although much slower than in the other two utilities; you can type faster than this auto-repeat), lower-case driver, restore lost Basic programs (if NEW is entered inadvertently), and seven keyboard-entry modes.

Mode 0 is standard TRS-80 uppercase keyboard: SHIFT for lowercase. Mode 1 is typewriter style: SHIFT for uppercase. Mode 2 is like Mode 0, except that a quotation mark permits entering graphics characters directly from the keyboard thereafter, a second " returns the keyboard to Mode 0, a third " gets back to graphics, etc.

The 64 graphics characters are input with SPACE, 0-9, @, A-Z and a-z, in that order.

Mode 3 is like Mode 2, except that the second " switches back to Mode 0 permanently. Mode 4 inputs graphics regardless of quotation marks. The auto-repeat feature operates in graphics modes; here, its slow speed is an advantage, allowing a precise number of graphics characters to be entered.

In Modes 5 and 6, SHIFT/A and SHIFT/X provide Basic shorthand on the first 24 alphabetic keys. Keys Y and Z provide user-definable strings of up to 32 characters each. In Mode 6, Basic keywords are printed with a trailing blank "when practical," according to the four-page manual, which says "this adds to the appearance of the listing at the expense of memory space." The "trailing blanks" are simply automatic single spaces provided after

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TRS-80, continued...

statements such as GOTO, POKE and INPUT, but not after SYSTEM, PEEK(, CSAVE", etc.

The keyboard-entry mode can be changed from software, with POKE statements.

No decals or press-on labels are provided for the Basic-shorthand keys.

Short Program 24: Fast Rectangles

Back in the July 1981 issue (p. 212), Short Program #19 "alternately set and reset random-sized rectangles at random locations on the screen while randomly stepping the loops."

The rectangles, created a row at a time, are sometimes solid or blank, sometimes made up of lines or graphics blocks. The effect is most pleasing, and looks like a form of modern art.

A slightly different version of the same basic idea was sent in long before S.P. #19, by ace programmer Leo Christopherson, but got mislaid awhile among all the TRS-80 stuff piled up here.

Leo's program does the same thing, but puts each rectangle on the screen instantly. Here's most of Leo's letter:

"Thank you for your complimentary comments about my program, Android Nim. I have been a great fan of *Creative Computing* for the last several years...

"I thought I would send you a short graphics routine which turns on rectangles of various sizes. This routine uses a small machine-level subroutine and does the printing on the screen quite quickly.

"The machine-level commands are:

```
 0. LDC/
 1. N(Number-of-rows)/
 2. LDDE/
 3. N(LSB-of-starting-address)/
 4. N(MSB-of-starting-address)/
 5. LDH,D/
 6. LDL,E/
 7. LDB/
 8. N(Characters-per-row)/
 9. LDA/
10. N(Character-to-be-printed)/
11. LD(HL),A/
12. INC,HL/
13. DJNZ/
14. 252D/
15. LDB/
16. 64D/
17. INC,DE/
18. DJNZ/
19. 253D/
20. DEC,C/
21. JRNZ/
22. 238D/
23. RET/
```

Figure 5.

"The decimal equivalents of these commands are put together into a string in line 110 of the Basic program. Line 120 gives X1 and X2, which are the LSB and MSB of the memory address where X$ begins, and line 130 gives X0, the decimal address of the first byte of X$. Line 140 POKEs X1 and X2 into the USR(0) address vector and sets USR(0) to the start of X$.

"Line 200 is very important. It makes sure that no POKEing will take place beyond the screen memory (which would likely 'crash' the program). Line 210 changes the PRINT @ address for POKEing into X$, and lines 220 and 230 POKE into the machine-level subroutine, X$, those values it needs. X=USR(0) calls the routine in X$.

"This is the Basic listing:

```
100 CLS
110 X$=CHR$(14)+CHR$(1)+CHR$(17)+CHR$(1)+CHR$(1)+CHR$(98)+CHR$(107)+CHR$(6)+CHR$
(1)+CHR$(62)+CHR$(1)+CHR$(119)+CHR$(35)+CHR$(16)+CHR$(252)+CHR$(6)+CHR$(64)+CHR$
(19)+CHR$(16)+CHR$(253)+CHR$(13)+CHR$(32)+CHR$(238)+CHR$(201)
120 X1=PEEK(VARPTR(X$)+1): X2=PEEK(VARPTR(X$)+2): X0=X2*256+X1
140 POKE 16526, X1: POKE 16527, X2
150 XA=RND(15): XC=RND(1020): XB=RND(64-(XC-INT(XC/64)*64))
155 XD=RND(64)+127
160 GOSUB 200: GOTO 150
200 IF(XC<0) OR (XC+XB+63*XA>1024) THEN RETURN
210 X4=INT((XC+15360)/256): X3=XC+15360-X4*256
220 POKE X0+1,XA: POKE X0+8,XB: POKE X0+10,XD
230 POKE X0+3,X3: POKE X0+4,X4: X=USR(0): RETURN
```

Figure 6.

"Lines 150 and 160 are my own little way to show off the rectangle program. The main point is that XA is set equal to the rectangle's height (XA =5).XB is the width (XB =3), XC isthe PRINT @ position on the screen of the upper-left corner of the rectangle, and XD is the ASCII or graphics character which is to make up the rectangle.

"I have used a number of variations of this sort of thing in my programs to give me the convenience of Basic and the speed of machine-level."

Leo's program adds several new patterns to the screen every second, so the display changes quite rapidly, often dramatically. You may prefer the slower, line-at-a-time version. Both are fascinating and almost hypnotic. □

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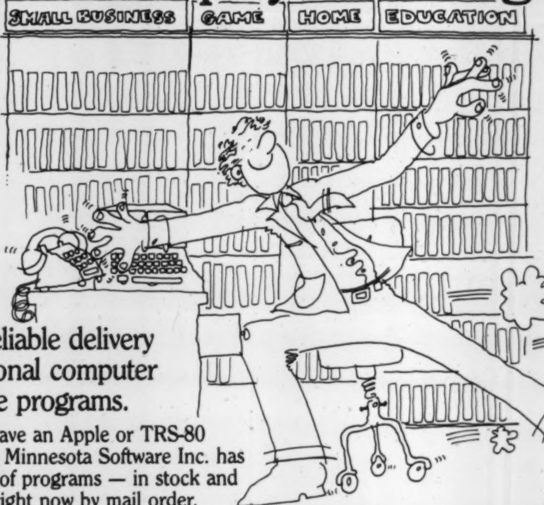

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Guide to Computer Music Systems by Phil Tubb primarily dicusses the design philosophy behind the ALF computer music system. It also covers the principles of computer music reproduction and compares three popular systems for the Apple II. $2.00.

Stocks and Listed Options by Alfred Adler is a collection of five articles about using a small computer for analysis of a stock portfolio with an emphasis on listed options. The booklet serves as the instruction manual for a 5-program package for the TRS-80 marketing by Creative Computing Software. $1.00.

Odell Woods. This is a program listing in Basic and instruction booklet for a popular MECC program. In it, the user plays the role of a fox, mouse or wolf and attempts to survive in the northwoods. The listing is in Applesoft Basic but uses few special features so it could be converted easily to other systems. $1.00.

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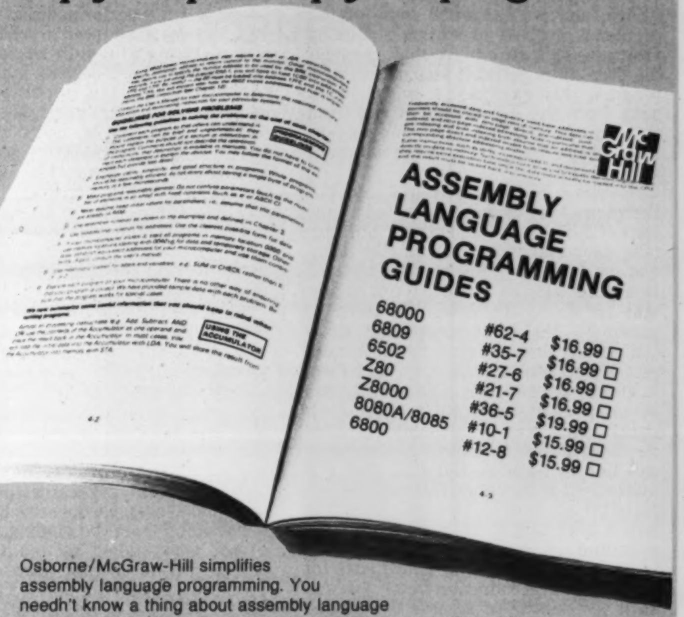

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CIRCLE 315 ON READER SERVICE CARD

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Correspondence is welcome. Letters with interesting questions and ideas will be used in the column along with a response. No personal replies can be made. Send to: David Levy, 104 Hamilton Terrace, London NW8 9UP, England.

David Levy

Last month we looked at one of the most popular card games, Contract Bridge, and we examined some of the problems involved in writing a bidding program. This month we shall consider the even more difficult task of writing a program that can play a bridge hand, both from the declarer's seat and from the seat of one of the defending players. Let us begin by looking at the nature of the problem.

Contract Bridge differs from most of the games that we have discussed in one respect that is not immediately obvious. (The fact that it is not a perfect information game is quite another matter.) In a game such as chess, it is not important to win in any specific number of moves — the important thing is to achieve the desired result and it is more pleasant to win in 25 moves than to win in 100. A program can play a good game of chess if it can avoid tactical oversights and play reasonably sensible strategic moves. Its overall performance will not be optimal, but that does not matter — it is the result that counts.

In bridge, and similar card games that have a trick-taking stage, there are only a limited number of 'moves' (ie, tricks) in the game. A hand of bridge lasts for 13 tricks, never more and never less, and so it is essential to achieve the desired result within those 13 tricks. For this reason, a bridge playing program must aim to determine a hopefully optimal strategy in order to maximise its chance of success. Even if bridge were a full information game, the number of 'moves' would make an exhaustive tree search prohibitive. There are 13 cards that can be led to trick one, 12 cards which can be led to trick two, and so there are 13(!) ways of selecting the card to be led to each trick. This number must be multiplied by the number of cards that may legally be played by the second, third and fourth players who play to a trick, and the result is a number so enormous as to make exhaustive search unfeasible.

A subset of this problem was solved by Berelekamp many years ago. He wrote a program to play 'double-dummy' bridge hands in No-Trumps. Double-dummy means that everyone can see all of the cards in all of the hands, so declarer is playing a full information game, and need make no estimate or guess of where particular cards lie in the defending hands. By reducing the problem still further, so that only No-Trump contracts were attempted, it was possible to write a program that performed satisfactorily. The approach adopted by Berelekamp was to create a hypothesis for playing the contract from declarer's hand, then to try to refute this hypothesis and to create an improved hypothesis.

This approach is really an intelligently directed exhaustive search. The intelligence, or bridge knowledge, is used to guide the search and hopefully any contract which can be made *will* be made before the program runs out of time. The serious reader will find it useful to read the original paper on this particular program.

In the real world of bridge, where the situation of the defenders' cards is not known exactly, programming becomes far more difficult. An expert bridge player will often be able to make an intelligent guess, after the bidding, as to how the suits are distributed between the defending hands, and he may also know or be able to guess the exact location of certain key cards, particularly the missing aces. He does this by gleaning information from the bidding, and those of you who studied last month's article will have realised that some of the information passed during the bidding can actually be used during the play of cards.

Very little has been done in the way of programming the play of the cards at bridge. There are two commercially available bridge computers, neither of which plays at the same level as the best chess programs, and there are a few other programs around which readers may have come across in the micro literature. One of America's leading computer bridge experts, Thomas Throop, has done much to popularise the subject in North America. He has a regular column in *Personal Computing* in which he describes how various hands were played by his own program, which runs on a mainframe, and on George Duisman's program, which is available for Apples and other personal computers. So far Throop has not discussed how his program works, so there is no available literature on the detailed programming of bridge play. But hopefully this situation will improve as more people become interested in computer bridge. In Britain, Dr Alan Stanier wrote his PhD thesis on the subject of bidding a bridge hand and then planning the play from declarer's seat, and much of my own understanding of the problem stems from my reading of his thesis. The ideas expressed in the present article represent a simplified distillation of Stanier's ideas and one or two of my own.

Stanier correctly emphasised the importance of having the playing program learn from the bidding. Perhaps the most obvious application is in trying to decide which way to play a *finesse*. Consider, for example, the following situation:

Spades: A J 5
Spades: ? Spades: ?
Spades: K 10 3

South is declarer and wishes to try to make three spade tricks. No spades have yet been played, so the defenders have seven spades between them, including the Queen. There are two ways of trying for three spade tricks, both involving a finesse. South can guess that the missing Queen is in West's hand, in which case South plays the King of spades, discarding the 5 from dummy, then the 3 — and if West does not play the Queen then dummy's card is the Jack. If South guesses that East has the Queen, the play is different: the 3 is played from South, dummy plays the Ace and leads back the 5 — if East does not play the Queen on dummy's 5 then South plays the 10, otherwise he plays the King, taking the Queen and winning the third trick with the 10.

If the defenders have bid, declarer might be able to make some deduction from the bidding which helps him decide which way to take the finesse. If West has bid spades, then it is a reasonable assumption that he holds the Queen. If East is the only defender who bids, and late in the hand he has already played cards with sufficient point values to justify his bid, it is not unreasonable to guess that West holds the missing Queen. Deductions similar to these are not difficult to program, and the reader can use his own knowledge of bridge (and what he can find in books) to suggest various deductive routines which might help the play of a hand.

How to Decide on a Strategy

The most difficult problem for a human bridge player will often come at the very start of a hand, before he decides which of dummy's cards to play on

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trick one. At that stage he must plan his strategy, and an incorrect strategy can result in the wrong card being played as early as trick one. We shall now examine a simple strategy which could be programmed on a micro.

When the bidding is over and the defender leads a card to trick one, declarer should count the number of sure tricks that can be seen. It is possible that the contract can be made simply by playing 'winners' until the required number of tricks has been taken. Such hands are not really interesting, as they require no particular skill or thought, apart from ensuring that the cards are played in the correct order so that the program does not get itself blocked (when it is forced to play from, say, dummy's hand when it really wants to play from its own).

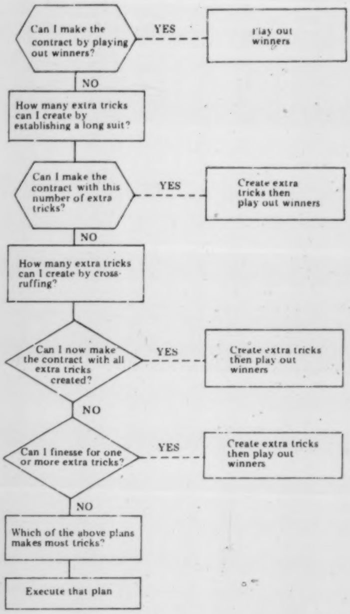
Can I make the contract by playing out winners?
YES
Play out winners
NO
How many extra tricks can I create by establishing a long suit?
Can I make the contract with this number of extra tricks?
YES
Create extra tricks then play out winners
NO
How many extra tricks can I create by cross-ruffing?
Can I now make the contract with all extra tricks created?
YES
Create extra tricks then play out winners
NO
Can I finesse for one or more extra tricks?
YES
Create extra tricks then play out winners
NO
Which of the above plans makes most tricks?
Execute that plan

Figure 1. Simple declarer strategy —flow chart.

If it is not possible for the program to make a contract merely by playing off top winners, it must try to create extra tricks in some way. Various techniques exist in bridge, whist and similar games for creating these extra tricks; some of them are simple, such as the finesse that we examined earlier, others are more complicated, such as squeeze plays — playing out so many winning cards that the defenders are unable to keep all their important cards. Our simple strategy will be to explore three different methods of creating extra tricks: the finesse, establishing extra tricks in long suits, and cross-ruffing. If one or more of these techniques appears likely to be successful, and the program 'thinks' that it has found a method of creating a winning plan, then it should follow this plan unless and until it is forced to re-think, ie, until the plan goes wrong. If the defending players deviate from the plan at any point, the program must reassess how declarer should play the hand, and this reassessment will usually result in a new plan. The flow chart for this strategy is given in Figure 1.

As I mentioned earlier, this strategy is rather simple, and will not provide a challenging game for strong bridge players. It should, however, allow the reader to write a program that plays an entertaining game for players below club strength. You will note that if the program is unable to generate a plan that either guarantees the required number of tricks, or at least gives some chance of making the desired number of tricks, then it will cut its losses and employ whichever plan results in the smallest number of penalty points.

Executing the Strategy

Once the most promising plan has been found, the program must decide in which order it is going to play the cards. Here the normal heuristics of bridge (and other trick-taking games) apply. The two most important principles to follow are:

a) When you are following a plan that involves giving away the lead at some stage, eg, playing a finesse or establishing a long suit by conceding one or more tricks, you must ensure that you have not weakened yourself in another suit to the extent that you can lose tricks unnecessarily. One common error made by beginners is leading out all their winners in a suit, thereby leaving themselves with one or more losers in that suit. Then, when a finesse fails or a trick is conceded while establishing a long suit, the vulnerable suit is attacked by the defenders and one or more trick is lost. The way to avoid this happening is to establish the long suit before playing off top tricks in other suits, unless you are aiming for a squeeze play (which is too sophisticated for our strategy).

b) Always ensure that the player on the lead is the player whom you want to be on the lead, and not his partner. A simple example of how things can go wrong is seen in the following situation:

Spades: 6 5 3
Hearts: A Q
Diamonds: —
Clubs: —

Spades: —
Hearts: K J
Diamonds: 4 3 2
Clubs: —

Let us assume that South has the lead, and that North's spades are the last three spades (and therefore they will all win), while South's diamonds are not the last three diamonds (and will therefore be losers). The contract is being played in No-Trumps. South leads the J of hearts, North plays the A, then North plays the Q of hearts and suddenly notices what he has done wrong. South must now take this trick with the K and then he is forced to lead a diamond, losing the last three tricks instead of winning with the remaining spades. Of course, there are various ways that the cards could be played in a different order, so that North-South would make all five tricks, but this example shows you how a careless mistake can cost several tricks and turn a good contract into a bad one.

End Play Situations

When a number of tricks have been played, the number of cards remaining in each of the players' hands becomes small enough to allow for some sort of exhaustive search of the game tree. How many tricks must be played before this type of situation arises will depend largely on two factors: the certainty with which the program is able to place all the remaining cards in the correct players' hands, and the speed of execution of the exhaustive search routine.

In the previous article, when we discussed the way that a hand might be bid, we saw how it is possible to put upper and lower bounds on the number of cards in each suit that is held by each of the players. These bounds can often be made more constrained during the bidding and once play begins they are constrained still further, as the exposure of dummy's cards provides more information. Finally, as one player shows out (ie, shows that he has no more of) a particular suit, the exact number of cards in that suit remaining in a player's hand can be determined.

Sooner or later, the program will be able to estimate the exact number of cards of each suit in each of the two unseen hands. Furthermore, from information gained during the bidding and the play, it may be able to arrive at an intelligent guess as to the location of some specific, high-value cards. It is then in a position to play what will have become a full-information game or, to be more precise, an almost full-information game (since it is likely that the exact location of one or two cards will remain unknown). When this stage is reached, the program can construct a two-person game tree of how the remaining cards might be played, and by searching this tree it can find the optimal way to play the last few tricks. This technique applies when the program is playing from either the declarer's seat, or from one of the defenders' seats.

During the play of the cards, the program should ask itself, as it is about to decide on its play to each trick, whether or not is has sufficient information to enable it to perform such a tree search. For this purpose, we should divide cards into 'important' and 'unimportant' cards. Loosely speaking, an important

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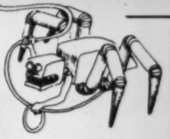

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Intelligent Games, continued...

card may be defined as one which, if its location is guessed incorrectly, will affect the result of the succeeding tree search. All other cards are 'unimportant'. Simple examples of both types of card are easy to find. If the defenders each have two remaining clubs and declarer has two clubs, both of which are higher than all of the defenders' clubs, then it is quite immaterial which way round the defenders' clubs are distributed, since declarer is bound to take both of the last two club tricks. But in the case of a missing Queen, which must be caught by a finesse carried out in the correct direction, a wrong guess as to the location of the card will result in the finesse going wrong, and at least one trick being lost which should not have been lost. So the missing Queen will be an 'important' one.

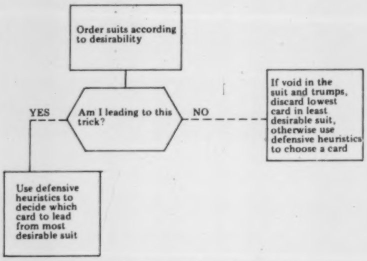
Order suits according to desirability
Am I leading to this trick?
YES
NO
If void in the suit and trumps, discard lowest card in least desirable suit, otherwise use defensive heuristics to choose a card
Use defensive heuristics to decide which card to lead from most desirable suit

Figure 2. Defensive flow-chart.

As a general rule, I would suggest that the program should not try an exhaustive tree search until the number of 'important' cards remaining is no more than one.

Having written your tree search routine, you will have an opportunity to try it out after different numbers of tricks have been played. This will enable you to time the execution of the routine where there are 3, 4, 5 . . . tricks remaining to be played. You can then decide what sort of time delay is acceptable to you, and set the 'end-play parameter' so that the exhaustive search does not begin until such time that the computer's delay in calculating its optimal play is acceptable. Remember — the computer can determine the optimal end-play strategy for defending players as well as for declarer, and since you will be playing one of the hands and the computer will be playing the two unseen hands, you must allow for a delay by both of the other players. Unfortunately, there can be a substantial difference between the times needed to search trees with the same numbers of cards (or tricks). This is because one tree-search might be performed in a near optimal ordering (ie, the search heuristics provide a good ordering of the 'moves') while another tree-search might be highly non-optimal in its ordering. Another reason for a large disparity in the search times is that even with the same number of *tricks* to be played, there can be vastly differing numbers of nodes on the search tree because of the way that the suits are distributed. If all the suits are evenly distributed among the players, the branching factor at each node will be small. If the suits are unevenly distributed, the branching factor at some nodes will be small and at others it will be large. The combinatorial effects of these differences might result in two trees having the same number of tricks but widely differing numbers of terminal nodes.

How to Play the Defense

Bridge books are full of useful defensive heuristics which can be used by your program, particularly at the very start of a hand when it is necessary to decide what to lead to trick one. Perhaps the best known such 'rule' is: when defending against a No-Trump contract, lead the fourth highest card of your longest suit. This type of lead tells your partner something about your longest suit and he can then decide how to play that suit. Another simple heuristic is that if you only have two cards in a particular suit, and declarer is playing a trump contract in another suit, you normally play the higher of your two cards first, then the lower of the two, so that if your partner gets the lead he can play another card in that suit and you will be able to trump (if you have any trumps) because by then you will be void in that suit.

Defensive heuristics can be employed to update the information that the program is keeping about the number of cards of each suit in each hand, and in certain cases it might also be possible to update information about specific cards. For example, if your partner leads the 8 of spades against a No-Trump and you can see the Ace, Jack and 9 of spades (in your own hand and dummy's hand), then if partner's lead was the fourth highest spade in his hand he must hold the King, Queen and 10.

The simplest strategy to program for defensive play is one which orders the suits in their 'desirability' from the defenders' point of view. A defending player should be able to decide which suit or suits will not be profitable for him to lead, and he can then rank the other suits so that when faced with a choice of what to lead at the start of a trick he can lead a card from the suit at the top of the desirability list. Reasons for putting a suit high on the desirability list are varied: a player may wish to lead a card merely to transfer the lead to his partner's hand; or he may wish to lead a card in his weakest suit so as not to give away any tricks by a bad lead; or he may have one or more winners in a suit and may wish to take them. The order of desirability will usually change quite often during the course of a hand, as more information is revealed about the distribution of the suits and the locations of certain cards. But the concept is not a difficult one to program.

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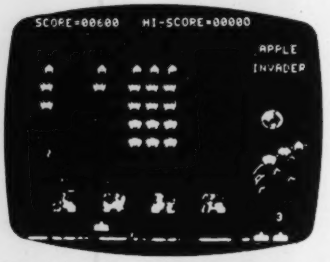

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Having ordered the suits in this manner, the program decides which card in the suit should be played on the basis of the various defensive heuristics that you have programmed. For this you will need to consult some books on defensive play. When the program must lead to a trick, it chooses the appropriate card from the suit at the need the services of one or more good top of the desirability list. If it must play second to a trick it will normally play the lowest card unless that card has already been beaten. When forced to discard from a different suit(i.e.,the card that was led is from a suit in which the defending player is void), the program should discard a card from the suit that is currently bottom of the desirability list.

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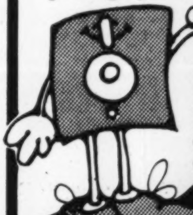

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Contrast Lead: "The president of the United States sat behind his disk, nervously drumming his fingers." This stands out. It teases your curiosity. Why is he doing that? You want to know more, and so you read on for an explanation.

Question Lead: "Why is the president of the United States nervously drumming his fingers on the desk?" If you use this type of lead, it is almost always better to ask a question rather than answer one. Entice the reader.

Figurative Lead: This uses metaphors ("the rosy-fingered dawn") or similes (comparisons that use the words "like" or "as": "The sky was like a pool of black oil"). When you use this kind of lead it's important to avoid using cliches or alliteration ("wumpy wallowing wallaby").

Stacatto Lead: This is good to use when you have to emphasize time or fast action: ("Got up. Got out of bed. Dragged a comb across my head.") Use very short sentences to suggest rapid movement.

Epigrams: These are concise, pointed, or witty sayings. Familiar epigrams are the best: "There never was a good war, or a bad peace."

Literary Allusion: This is an indirect reference to a well-known book or character, such as "He was a Simon LeGree."

Quotation Lead: Here you can quote someone you are interviewing, or an expert in the field about which you are writing. This should be used only if the quote is really extraordinary and eye-catching: "Our strike will bring the entire country to a grinding halt. We couldn't be happier."

Dialogue Lead: Here you use the interplay of the people in a featured situation to give the reader several different points of view rapidly:

"What do you think of the new Klankomatic printer?" George asked.

"Fine for scaring small animals and children, but I wouldn't buy it," Bill responded. "I've heard jet engines that are quieter."

"Doesn't bother me," said Kerry. "I do all my programming with headphones on. I think it's a good buy."

Cumulative Interest Lead: These build interest gradually, in a progression. You answer all the "who, what, when, where, why, and how" questions for the reader bit by bit—after arousing his interest about them. Say something provocative and then keep the reader in suspense for a while:

"It walks on three legs. It lives in Australia. But one hasn't been seen for over thirty years."

"I had a scary run-in with one back in 1925," said a toothless old prospector...." (Hopefully by now you've got the reader "hooked.") This is an example of a suspended interest lead—you hold the answer to one question until the very end. Paul Harvey's "The Rest of the Story" radio broadcasts are excellent examples of this technique.

Direct Address Lead: This is used mostly in newspaper columns that deal with a specific topic, such as medicine. They are tricky to use, because you automatically eliminate some of those reading the lead: "Attention, arthritis suffers." If you don't have arthritis, your eye moves on.

Beware the Bad Lead

However, a bad lead can turn your readers off as quickly as a good lead can grab them. There are several things to watch out for here.

The first thing to avoid is the "say nothing" lead such as, "The committee met." Apply the "so what?" test here to check if you've really said something important that will catch the reader. Here the writer missed the point. He needs to say *why* the committee met—or what they've done that is really newsworthy.

The opposite of the "say nothing" lead is the "say everything" lead. This does not really give the reader anything but a feeling of being cluttered. Beware of trying to tell the reader too much in one sentence. Remember that you want to arouse his curiosity and *then* tell him the facts you've sparked his interest about. Don't just throw a bunch of facts at him.

The "tasteless lead" will also do you in if you don't watch out. This is more of a problem for crime writers, although you must always take care not to offend your readers.

Treating a serious problem lightly is another way to offend or turn off readers. A story about jackrabbits overrunning the county may seem humorous to you, but it isn't to farmers and landowners who are having their property destroyed.

Finally, you should avoid the type of sensational leads used by less-than-reputable gossip newspapers. Readers quickly grow weary of gross exaggerations. If you dramatize something, make sure it deserves it.

If you look at your newspaper each day with these things in mind, you'll begin to acquire a gut sense of what "works" and what doesn't.

How do you know you're reading a good lead? When the lead is good, the rest of the story will follow smoothly. The theme of the story will be reflected in the lead. You may find yourself at the end of a story you had no intention of reading in the first place—because the lead pulled you into a well-written story.

Stay with your daily course. You may want to make some notes as you read. It's also fun to look at a news story and try to write a different lead than the reporter used. There is no one "right' lead for each story. Can you come up with a better one than he did? What type of lead would you use?

Put It To Work For You

Once you think you know what makes a good lead, don't stop there! Leads aren't just for news stories. You can use the same techniques for capturing a reader's attention at the start of your memos, reports, articles, term papers...even personal letters! How can you best interest your boss, editor, teacher, friend, or student in what you want to tell him? See if that doesn't perk up your reader and make him want to continue. It will help you to get your point across.

Now that we've shown you how to find a free writing course and the time to take it, how to use it, and how to apply what you learn from it, we've solved all your problems but one. Only one thing remains.

What are you going to do with all the unwrapped fish? Hmmmm....sounds like that would make a good lead for a "How I Learned To Write From the Newspaper" article. □

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Stephen B. Gray

Data Structures Using Pascal, by Aaron M. Tenenbaum and Moshe J. Augenstein. Prentice-Hall Inc., Englewood Cliffs, NJ. 557 pages, hardcover $23.95. 1981.

Written by the authors of a similar book on PL/1, this textbook is designed for a two-semester course in data structures and programming. The text includes programming because the authors found while teaching a course in data structures, "that a considerable amount of time was spent in teaching programming techniques because the students had not had sufficient exposure to programming and were unable to implement abstract structures on their own."

The nine chapters cover Information and Meaning, The Stack, Recursion, Queues and Lists, List Processing, Trees, Graphs and their Applications, Sorting, and Searching. The appendix presents "information on Pascal that students may not have seen in an introductory course," such as scalar data types, packed arrays, records, scope of identifiers, etc., a dozen in all.

Algorithms are presented in a language intermediate between English-language descriptions and Pascal programs, written in Pascal style interspersed with English.

The text is easily understood by those with a little knowledge of programming; the bright reader may need none at all, although he'll find that some parts of the text don't linger on long explanations.

The writing is semi-formal and packs a great deal of information into each chapter; it is all lean meat with a no-nonsense style. This may be the best Pascal textbook that also teaches programming; it may also be the only one.

Son of Cheap Video, by Don Lancaster. Howard W. Sams & Co., Indianapolis, IN. 223 pages, paperback $8.95. 1980.

This sequel to *The Cheap Video Cookbook* contains improvements, simplifications and new ideas in low-cost ways of getting alphanumerics and graphics video out of a microcomputer and onto an ordinary television set.

Chapter 1 describes a video display system that can be built for as little as $7, using five cheap ICs and eliminating "one or both of the custom PROM memories used in cheap video."

Chapter 3 involves a do-it-yourself EPROM character generator. Chapter 4 gives a detailed example of a music-display system as an example of what you can do with customer graphics. It displays clefs, notes, etc., but the chapter doesn't include a photo of a screen displaying it all, to show us what the total picture is like.

The next two chapters show how to run cheap video on 8080 and Z80 systems. The last two chapters involve lower-case hardware and software for the Apple II, at a total cost that "can be under $9."

Three appendixes give "more character generator details," pinouts of selected ICs, and printed-circuit patterns for two circuits.

A note on page 4 says the cheap video PC boards, kits, assembled units, and program tapes are available commercially from PAIA Electronics, in Oklahoma City.

Having written half-a-dozen similar books for Sams, King of the Electronic Cookbooks, Lancaster knows just how to provide all those little details needed by that hardy band of do-it-yourself soldering-pencil enthusiasts to build projects that work, and to understand how they do. Even if you don't build anything described in this book, you'll learn a great deal about video, EPROMs, character generators, and much more.

Basic: A Hands-On Method, by Herbert D. Peckham. McGraw-Hill Book Co., New York. 318 pages, paperback $12.50. Second edition, 1981.

This second edition includes "several important changes...in response to suggestions received from users of the first edition," reviewed here in July 1979 (p. 157). The preface also says the most significant of the changes is the inclusion of a new chapter on strings and string operations. Also, the number of problems has been doubled, and a glossary has been added.

Otherwise, this book is very much like the first edition. Each chapter begins with a statement of the objectives for that chapter. The book is spiral-bound to lie flat when used with the time-sharing computer students must have access to. Blanks are provided for the student to fill in the answers to hundreds of questions asked throughout the text.

The new chapter on strings gets around the problem of string operations being handled differently on various computers by using lower-case substitution functions in Basic statements. "The student then replaces the substitution functions with the function [contained in Appendix A] appropriate to the computer which is being used."

The new chapter starts by asking the reader to enter programs, observe the results, and answer questions based on the results. After nine pages of 22 "Discovery Exercises," the author discusses strings, gives some program examples, then ends with problems and a practice test.

Peckham maintains his conversational style, his simple and clear writing, and the use of lively drawings, in a book that is still highly recommended for hands-on use, and which is even more useful in this second edition. Solutions to odd-numbered problems are provided.

Murder In The Mansion, And Other Computer Adventures In Pocket-Basic For The TRS-80, by Jim Cole. ARCsoft Publishers, P.O. Box 132, Woodsboro, MD 21798. 64 pages, paperback $5.95. 1981.

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eviews...book r

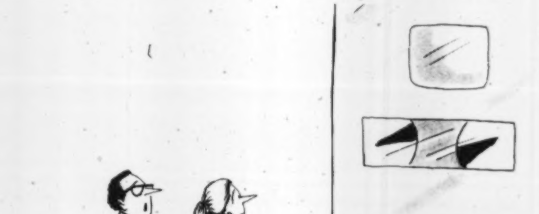
The second adventure, Lost Safari, asks where the safari is, and loops forever until you guess the correct location; same with which animal they're hunting, and how many days to find them. However, you're scored on this one; the more you guess, the lower your score.

And so it goes with Saturn Death (interplanetary flight), Buried Treasure, The Black Pearl, Memory Test (remembering flashed nonsense sentences), Scrambled Egg (only 12 scrambled words), Barrel of Apples (guess a number), Wood Chuck Chuck (guess a number), and Fractured Descriptions.

The book (actually more of a booklet) ends with Pocket Computer Basic abbreviations, two random-number programs (first one converges rapidly), and an ad for the ARCsoft "Pocket-Basic Coding Form." A nice book for kids, although entering 60-odd lines per program on the small keyboard may be difficult for some.

Guide to Systems Applications, by John F. Grillo and J.D. Robertson. Wm. C. Brown Co., 2460 Kerper Blvd., Dubuque, IA 52001. 277 pages, paperback $17.95. 1981.
Techniques of Basic, by John P. Grillo and J.D. Robertson. Wm. C. Brown Co., 267 pages, paperback $18.95. 1981.
Introduction to Graphics, by John P. Grillo and J.D. Robertson. Wm. C. Brown Co., 140 pages, paperback $15.95. 1981.
Data Management Techniques, by John P. Grillo and J.D. Robertson. Wm. C. Brown Co., 201 pages, paperback $16.95. 1981.

These four "Computer Guidebooks" comprise the Brown Company's Microcomputer Power Series that includes a total of 208 Basic programs (61, 61, 38 and 48, respectively), all in TRS-80 Level-II Basic.



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"Evidently, memory is a two-way street!"

The *Guide to Systems Applications* "begins at an elementary level and builds your knowledge of hardware and software to the level necessary to understand the complexities of microcomputer systems and their applications," according to the back cover, which adds that "its unique APPLICATIONS approach stresses the programs (rather than the hardware) and how they are created to build applications systems."

The eleven chapters are on Microcomputers in Perspective, General Aspects of a Computerized Organization, The Microcomputer, Software, Extended Basic, Systems Requirements, Applications Hardware and Software, File Manipulation, Systems Design and System Programming. Each chapter ends with a summary and a list of suggested "readings," including many from this magazine.

Four appendixes provide a memory-test program, a list of sample microcomputer applications, ASCII codes, and accounting-system numbers you might use in a home expenditures program. A good 14 1/2-page glossary concludes the book.

The guide goes into more detail than some readers may want, but nearly all of it would interest anyone buying a book with this title. Although the writing style is formal, the text is very clear, very simple, and often quite detailed. The third chapter, for instance, goes into the PROM and EPROM, 8080 registers, and motherboards.

The teaching of Basic begins in the Software chapter, after a brief mention of assembly language and other high-level languages. It is done slowly and carefully for six pages, then presents two long programs that may throw the beginner who's had no experience with programming; the authors assume some familiarity with microcomputers.

The chapter on Extended Basic wisely says, "Teaching Basic is not one of the aims of this book; rather, the text should act with the vendor manual as a supplement and a source of suggestions." The authors assume the reader has a "personal computer or microcomputer" available. This is one of the best chapters in the book, although it could use more examples.

The last chapter provides three long programs, for home-expense accounting, gradebook (student grades), and mailing lists.

One curious feature: all four books, 8 1/2 by 11 inches in size, have a left margin that's an extra inch wide, for side-headings and for illustrations. It's not all that necessary, and adds 22 percent to the page width, or 195 pages to the total number of pages.

However, the extra margin does make for a nicer-looking book, on the few pages where it's used effectively, and helps justify the high cost of these books, which is in part due to the plastic bindings that require punching holes in the pages. This makes the pages lie flat.

Techniques of Basic goes into Decisions and Branching, Statements and Functions, Input and Output, Variables, Graphics, Strings and Disk Basic, Sequential and Direct Access File Processing, Conversational and Structured Programming, Documentation, File Manipulation Techniques, and an Inventory System Application.

The 61 Basic programs cover topics such as simple data analysis, conversational statistics, isotherm graphing, text processing, line renumbering, banner printing, message

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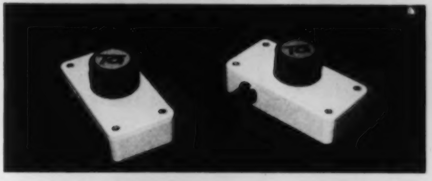

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managing, error trapping, realtime stopwatch, Shell sorts, Quick sort, Monte Carlo techniques, and binary search trees.

Many interesting and useful techniques are provided here, in very clear prose, ranging from how to program the four ways a ball can bounce off a vertical wall, to "praise and chastisement" in computer dialogs.

This is a very helpful book that also looks into many Basic statements, such as INKEY$ and DEFUSR, much more thoroughly than Radio Shack's Level-II manual.

Introduction to Graphics is also available, without the lay-flat plastic binding, in a regular wraparound cover from Radio Shack for $7.95, a much more reasonable price.

This book shows how to make pictures using TAB, formulas, tables, characters, graphics blocks, and motion graphics. The 38 programs draw the Bentley College logo, sine curves, thermal gradients, a silhouette of a witch, moving messages, a large-digit digital clock, lines and circles, a dot bouncing of a wall, etc. The screen photos in these four books, incidentally, are excellent, among the very best I've seen yet, all 4 by 5 inches, all very clear, accompanying just about every program in the book.

If you're interested in TRS-80 graphics, take a look at this one in a Radio Shack store; you'll probably buy it, even though the 96 photos do seem to have been used, in many cases, to pad out the book, at two per page. With only a slight reduction in size, and without the large black border that simulates the monitor case, 24 pages could easily be cut from the book's length, or used to provide more text about graphics. Even so, the book is a winner.

Data Management Techniques is, according to the back cover, designed for the intermediate to advanced programmer, and shows how to manage most popular methods (such as list and array processing) and some less well known, but very powerful methods (such as queue, stack and tree processing)."

The book's 48 programs illustrate techniques such as sorting, ISAM file creation and upkeep, linked list file management, generalized information system with a binary-sequence search tree, automated code generation, master-file maintenance with transaction-file merging, and multilist file-management system.

The eight chapters are on Pointers, Sorting, Strings, Linear and Linked Lists, Sequential and Direct Access Files, Trees, and Inverted Files. The emphasis here is not on CRT photos, as was the graphics book; there are only 17 CRT photos, and eight of those are for chapter headings. The emphasis is rather on program LISTings and RUNs. With 46 programs presented, some of them are more sophisticated versions of previous ones.

There are programs that play Nim heuristically, use Monte Carlo selection for equal inheritances, generate aphorisms, sort, play Mastermind, produce KWIC indexes, analyze word frequencies, sort-merge sequential files, create a book's index, search files, play a library quiz game, etc. Chapter 8, Inverted Files, is built around a five-page list of movies, and presents programs that insert new titles into the file, list films by various categories, etc.

This book is valuable for the programs alone, and doubly valuable because it shows at length how these programs are created and how they work. It's worth every bit of its high price. □

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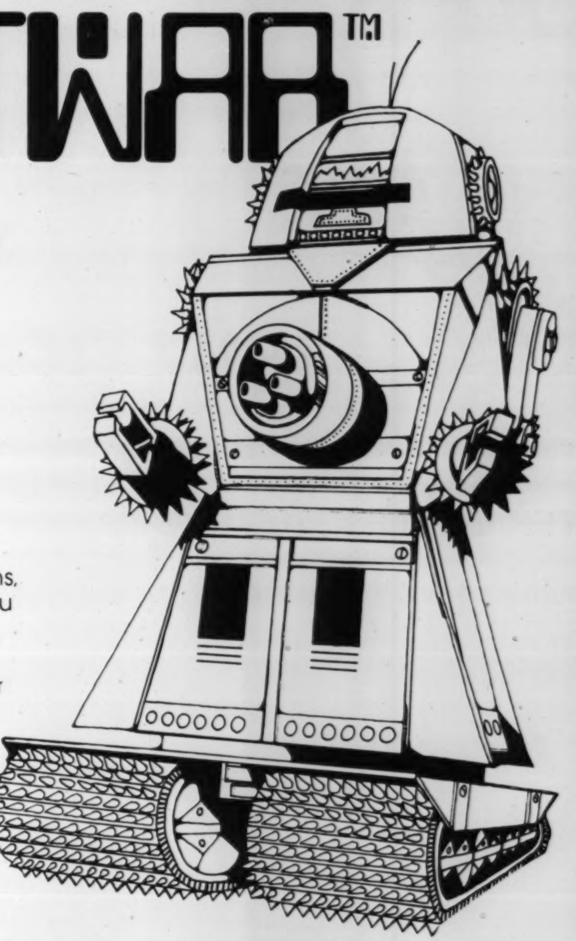

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The Battlefield... Challenge up to four competitors from the Robot Ready Room on your disk. Your robot will meet them in the arena where you have a bird's eye view of the mechanical carnage. Robots scurry about, radars flash, lasar shots fly and explode... and only one survives. You're the witness to a futuristic Gladiator spectacle.

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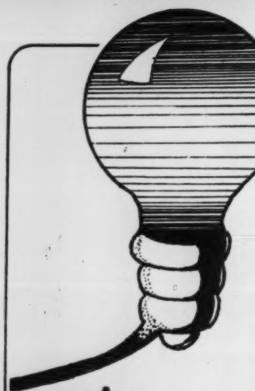
CIRCLE 225 ON READER SERVICE CARD



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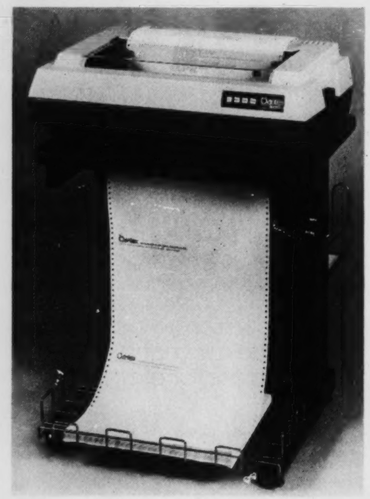
TERMINALS & I/O

PRINTER FEATURES EXPANDED MESSAGE BUFFER



The Qantex Series 6010 provides a safeguard against loss of data with its standard message buffer expandable to 4K.

The standard 2K allows printing of a full CRT (1920 characters) screen without restraint pauses.

The printer is microprocessor-controlled and operates at a print speed of 150 characters per second with a 9 x 9 dot matrix. It is available with Centronics-compatible parallel or RS-232 serial interface operating at maximum baud rates up to 19,200 baud.

Standard features include full operator controls, built-in test, true descenders and underlining, logic seeking, manual paper advance, out-of-paper sensor and tractor paper feed.

Suggested retail price is $1550 with parallel interface; with serial interface $1580.

Qantex Division, North Atlantic Industries, Inc., 60 Plant Ave., Hauppauge, NY 11787. (516) 582-6060.

CIRCLE 351 ON READER SERVICE CARD

TOUCH-TONE TERMINAL

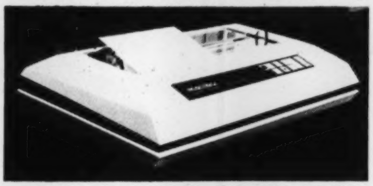
Perception Technology announces the Touch-Tone Terminal for voice response systems which is designed to simplify data entry, minimize errors, reduce input time, and provide faster information retrieval.

The terminal consists of a power supply unit and keypad with acoustic coupler. The keypad has 10 digits, the complete alphabet and four function keys. The acoustic coupler connects to the mouthpiece of any telephone.

Perception Technology Corporation, 95 Cross St., Winchester, MA 01890. (617) 729-0110.

CIRCLE 352 ON READER SERVICE CARD

DUAL MODE MATRIX PRINTER



Major product features of the Malibu Dual-Mode 200 include Z-80 microprocessor control, high-speed font (165-250 cps), letter-quality font (42-70 cps), program-controlled selection of up to 12 fonts, and a nine-wire printhead.

The dot matrix in high-speed mode is 9 x 9; in letter quality mode, 19 x 18. The 96-character ASCII set has characters that are expandable 2x and 4x, horizontally and vertically. The printer also offers "dot control" graphics capability with resolutions of 60 x 72 or 120 x 144 dots per inch.

Communications are through RS-232C serial or ASCII parallel interfaces; serial data transmission speeds are from 110-9600 baud. $2995.

Malibu Electronics Corporation, 2301 Townsgate Rd., Westlake Village, CA 91361. (805) 496-1990.

CIRCLE 353 ON READER SERVICE CARD

PERIPHERALS

LIGHT PEN FOR TRS-80 MODEL III

A self-contained light pen which plugs directly into the TRS-80 Model III has been announced by the 3G Company. The pen also works with the TRS-80 Model I.

The 3G Light Pen makes it possible to bypass the TRS-80 keyboard and interact directly with the information displayed on the CRT screen.

POINT PEN TO CORRECT ANSWER
WHERE IS MT. ST. HELENS?
OREGON
WASHINGTON
MONTANA

A demonstration game cassette, sample program and complete programming booklet are included with the pen. $39.95.

3G Company, Incorporated, Rt. 3, Box 28A, Gaston, OR 97119. (503) 662-4492.

CIRCLE 354 ON READER SERVICE CARD

INTELLIGENT INTERFACE CONTROLLER AND PRINT BUFFER

The Digilink is a microprocessor-based device which can be used as an intelligent switch or print buffer device. It can be configured to connect two dissimilar terminals to share one modem or connect two remote CPUs back to back with a monitor terminal on a third port.

Each individual RS-232 port can be independently set up through keyboard commands to accommodate devices with different baud rates, parity, X-on/X-off, fill characters, buffer length, auto line feed, etc.

The unit can also be used as a print buffer which can increase throughput between slow peripherals and host computers. When used in this fashion the Digilink accepts data from host computers at higher speeds and transfers it to slower speed off-line printers or other peripherals through either parallel or serial RS-232 interface ports. $775.

Data Systems, Inc., 1440 Koll Circle, Suite 110, San Jose, CA 95112. (408) 279-8711.

CIRCLE 355 ON READER SERVICE CARD

BIOFEEDBACK DEVICE

Total Digital Engineering announces the Biocom, an attachment which is said to make almost any computer an extension of the senses.

The Biocom works by measuring the emotional state of the user, and giving biofeedback via the video screen. Supplied software programs in Basic are for learning controlled relaxation, testing subliminal response and computer Ouija. The device is RS-232 compatible. $125.

Total Digital Engineering, 210 Daniel Webster Hwy., Nashua, NH 03060. (603) 883-0991.

CIRCLE 356 ON READER SERVICE CARD

TOUCH-SENSITIVE CRT KIT

Interaction Systems, Inc. announces a touch-sensitive CRT add-on kit for incorporation into the Lear Siegler ADM 32 video display terminal.

The TK-232 consists of a single printed-circuit board that is connected by cables to a heat tempered glass screen with 32 touch-sensitive pads. The microprocessor-based logic senses variance in ambient conditions, while the touch-sensitive faceplate detects differences in capacitance.

An ADM 32 terminal, equipped with a TK-232, will respond to the touch of the finger on data displayed on the screen.

The TK-232 is priced at $995 for the 15", and $945 for the 12" screen.

Interaction Systems, Inc., 24 Munroe St., Newtonville, MA 02160. (617) 964-5300.

CIRCLE 357 ON READER SERVICE CARD

SYSTEMS SOFTWARE

Quic-N-Easi combines a screen builder and content editor with a full interpreter language to produce a product for fast applications development for microcomputers. Written in Z-80 assembler, the program runs under CP/M. $395. Standard MicroSystems, Inc., 136 Granite Hill Ct., Langhorne, PA 19047. (215) 968-5966.

CIRCLE 358 ON READER SERVICE CARD

AIEEEEE!
IN A COLD CORRIDOR OF THE CASTLE, ANOTHER ALLIED SOLDIER IS INTERROGATED...
SCHWEIN-HUND! YOU REFUSE TO COOPERATE... YOUR INSOLENCE IS USELESS...
BUT HOURS LATER, AS DAWN BREAKS ON CASTLE WOLFENSTEIN, A SOLITARY FIGURE MAKES HIS WAY OUT OF THE FORTRESS AND TOWARD FREEDOM...
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CIRCLE 226 ON READER SERVICE CARD

New Products, continued...

Interactive Microware announces the **Basex interactive compiler and loader** programs on cassette for Heath H8 computers. This version of Basex includes a custom console driver and commands to save and load programs on tape. $33. Interactive Microware, Inc., P.O. Box 771, State College, PA 16801. (814) 238-8294.

CIRCLE 359 ON READER SERVICE CARD

The Formula is a complete system language designed to aid in the development of business applications on Z-80 or 8080 based computers running CP/M. By creating a structure for designing systems, the system generates program-like modules. $595. Dynamic Microprocessor Associates, Inc., 545 Fifth Ave., Suite 1400, New York, NY 10017. (212) 687-7115.

CIRCLE 360 ON READER SERVICE CARD

The DMM-1 Utility software disk from Elliam Associates includes: XDIR, which displays the disk directory in alphabetical order and shows the file size; Extract, which will list a portion of a file between two label names; Strip, which will remove the hex code from a PRN file and turn it back into an ASM file; Sort, which will create a symbol table from an assembly done with ASM that can be listed or used with the Digital Research debugger SID; Convert, which changes all uncommented lower case characters to upper case; and Status, which provides information about the current operating system. DMM-1 comes on 8" or 5 1/4" disk for CP/M users. $35. Elliam Associates, 24000 Bessemer St., Woodland Hills, CA 91367. (213) 348-4278.

CIRCLE 361 ON READER SERVICE CARD

Chat is designed to convert an Apple computer with a Hayes Micromodem into a communications system. Features include: automatic log-on to networks, simple configuration, character filter, non-keyboard characters, and phone answering. $40. Lovell's, 4205 Biltmore, Corpus Christi, TX 78413. (512) 852-3096.

CIRCLE 362 ON READER SERVICE CARD

Clone Software announces an **Assembler and Text Editor** for the Apple II, which features a disk-based, line-oriented text editor and 6502 assembler. The program requires a 48K Apple with two disk drives. $39.95. Clone Software, 1446 Estes St., Lakewood, CO 80215. (303) 234-0630.

CIRCLE 363 ON READER SERVICE CARD

Radio Shack offers a **Basic language compiler** for TRS-80 Model I and Model III computers. The RSBasic development system is a business-oriented language which allows the user to write programs in Basic while taking advantage of the extra speed and accuracy of a low level language. RSBasic requires a 48K TRS-80 with dual disk drives. $149. Available at Radio Shack stores, Computer Centers and participating dealers.

CIRCLE 364 ON READER SERVICE CARD

The SCS80C is a complete **6809 editor, assembler and monitor** package for the TRS-80 Color Computer. All three programs are co-resident and contained in one program pack. $89.95. A **disassembler** for the Color Computer enables users to generate source listings of the Basic interpreter ROM. It is available on cassette, and requires a 17K system. $49.95. The **CBug Monitor** includes 19 commands and is relocatable and re-entrant. $29.95 on tape. The Micro Works, P.O. Box 1110, Del Mar, CA 92014. (714) 942-2400.

CIRCLE 365 ON READER SERVICE CARD

Eastern House Software has announced an unbundled MAE **Software Development System** for Commodore 2001, 4001, and 8032; Apple II and Atari 400 and 800 computers. Features include: macros, conditional assembly, interactive assembly, up to 31 characters per label, and string search and/or replace. $169.95. Eastern House Software, 3239 Linda Dr., Winston-Salem, NC 27106.

CIRCLE 366 ON READER SERVICE CARD

APPLICATIONS SOFTWARE

GAMES AND RECREATIONAL

The Battle of Shiloh recreates the setting of the most crucial battle of the American Civil War and allows the players to control brigade-sized units during three phases: movement, artillery, and combat. **Tigers in the Snow** simulates the German offensive of December 1944. The Germans attempt to destroy the Allies' stronghold while the outnumbered Allies try to hold on until their reinforcements arrive. Both games

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CIRCLE 108 ON READER SERVICE CARD

are available on disk for the 48K Apple with Applesoft ROM card ($39.95) and on cassette for the 16K TRS-80 Model I or III ($24.95). Strategic Simulations Inc., 465 Fairchild Dr., Suite 108, Mountain View, CA 94043. (800) 227-1617, ext. 335; in California, (800) 772-3545, ext. 335.

CIRCLE 367 ON READER SERVICE CARD

Sirius Software announces three games for Apple computers. **Copts and Robbers** places the player in an Egyptian pyramid from which he must escape with treasures. The maze is larger than the screen, and scrolls as the player moves about. $34.95. **Outpost** is a space attack game which offers eight levels of play, user-defined keys, sound on/off, escape for temporary interruption of game, and a restart function. $29.95. The object of **Beer Run** is to catch Artesians by climbing up one building and down another. $34.95. All three games require a 48K Apple with disk drive. Sirius Software, Inc., 2011 Arden Way #2, Sacramento, CA 95825. (916) 920-1939.

CIRCLE 368 ON READER SERVICE CARD

Automated Simulations offers the first in a series of expansion modules for Temple of Apshai and Hellfire Warrior. **The Upper Reaches of Apshai** makes use of Temple of Apshai programs, but offers new monsters and treasures. In **The Keys of Acheron**, the player is again a Hellfire Warrior who must recover four keys from the rule of Kronus the demon. Both modules allow the player to generate new characters or take along veterans of previous adventures. Both modules are available on cassette for the 16K Level II TRS-80 or on disk for the 32K TRS-80 and 48K Apple with Applesoft in ROM. $19.95.

Additional announcements from Automated Simulations are a new two-player option for Invasion Orion and a version of Star Warrior for the Atari 800. **Invasion Orion** is available on cassette for the 32K Apple with Applesoft in ROM, 16K Level II TRS-80, 16K PET, and 32K Atari 400 or 800, and on disk for the 48K Apple with Applesoft in ROM, 32K TRS-80 and 32K Atari 400 or 800. $24.95. **Star Warrior** comes on cassette or disk for the Atari 800 with 32K RAM. $39.95. Automated Simulations, P.O. Box 4247, Mountain View, CA 94040.

CIRCLE 370 ON READER SERVICE CARD

Cross Clues is a game in which two players, umpired by the computer, compete to uncover an interlocking matrix of English words. It contains 50 different word games, and requires a 48K Apple with Applesoft and disk drive. Science Research Associates, Inc., 155 N. Wacker Dr., Chicago, IL 60606.

CIRCLE 371 ON READER SERVICE CARD

Magikube is a computer version of Rubik's Cube for the Radio Shack Color Computer. It includes a tape save feature which allows the player to save a cube and continue later. $19.95. Computerware, Box 668, 1472 Encinitas Blvd., Encinitas, CA 92024. (714) 436-3512.

CIRCLE 372 ON READER SERVICE CARD

Dynacomp has introduced three game packages for the Atari 400 and 800 computers. Each employs a joystick as well as sound and graphics. **Alpha Fighter** requires the player to destroy the alien starships passing through his sector of the galaxy (cassette, $14.95; disk, $18.95). **Intruder Alert** places the player in the middle of a "Dreadstar" with the goal of avoiding droids while trying to find a ship in which to escape (cassette, $16.95; disk, $18.95). **Giant Slalom** pits the player against a downhill course which includes both open and closed gates (cassette, $14.95; disk, $18.95). Dynacomp, Inc., 1427 Monroe Ave., Rochester, NY 14618. (716) 442-8960.

CIRCLE 373 ON READER SERVICE CARD

Castle Wolfenstein is an action-adventure game designed to bridge the gap between arcade and adventure/fantasy games. The player is an Allied soldier in World War II who has been captured and brought to Castle Wolfenstein for interrogation. His challenge is to find the Nazi war plans and escape without being recaptured or shot. The game requires a 48K Apple II with disk drive. $29.95. Muse Software, 300 N. Charles St., Baltimore, MD 21201.

CIRCLE 374 ON READER SERVICE CARD

Astroidz for the PET is based on the arcade game in which the player must destroy the astroidz which invade his galaxy. In **Munchman**, the player must work his way through a maze avoiding Zip and Zap. Both games are available on cassette for the 8K PET. $9.95. ComputerMat, Box 1664, Dept. P, Lake Havasu City, AZ 86403. (602) 855-3357.

CIRCLE 375 ON READER SERVICE CARD

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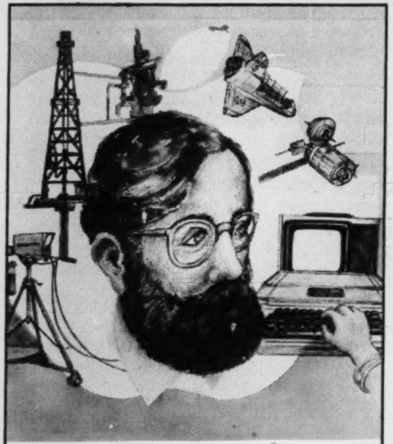

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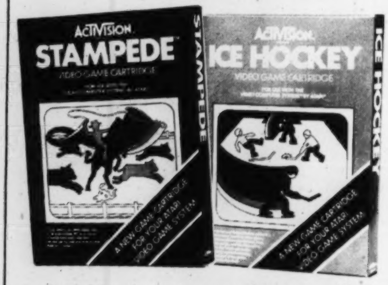
CIRCLE 152 ON READER SERVICE CARD

New Products, continued...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ICE HOCKEY
VIDEO GAME CARTRIDGE
A NEW GAME CARTRIDGE FOR YOUR ATARI VIDEO GAME SYSTEM

Activision has announced two cartridges for the Atari Video Computer System. In **Stampede**, the player directs a cowboy trying to round up a herd of stampeding dogies. $22.95. In **Ice Hockey**, the player may challenge a human opponent or the computer. $31.95. Activision, Inc., 3255-2 Scott Blvd., Santa Clara, CA 95051. (408) 727-7770.

CIRCLE 376 ON READER SERVICE CARD

Advanced Operating Systems has released **Voyage of the Valkyrie**, an interactive game by Leo Christopherson. The program involves the player in the exploration of the mountainous terrain of the Island of Fugloy as he tries to find 10 castles. The program is available for TRS-80 Models I and III on cassette and disk, and for the 48K Apple with paddles on disk only. Cassette, $34.95; disk, $39.95. Advanced Operating Systems, 450 St. John Rd., Michigan City, IN 46360. (219) 879-4693.

CIRCLE 377 ON READER SERVICE CARD

EDUCATIONAL

Edu-Ware Services has announced the availability of **Compu-Read 3.0** ($29.95) and **Compu-Math Fractions** ($39.95) in Atari Basic. The new versions require a 48K Atari. Edu-Ware Services, Inc., 22222 Sherman Way, Suite 203, Canoga Park, CA 01303.

CIRCLE 378 ON READER SERVICE CARD

Weather Fronts, first in the Lesson-Tutorgraph series from T Y C Software, provides an introduction to the concept of weather fronts, their structure and nature. Concepts presented include front characteristics, frontal movement, and weather characteristics of different types of fronts. **Shore Features**, another in the series, is designed to acquaint the student with the geographical features of the shore/beach area of the coast. Both lessons are available on disk for the Apple with Applesoft in ROM or the Language system, one disk drive and DOS 3.3, and are appropriate

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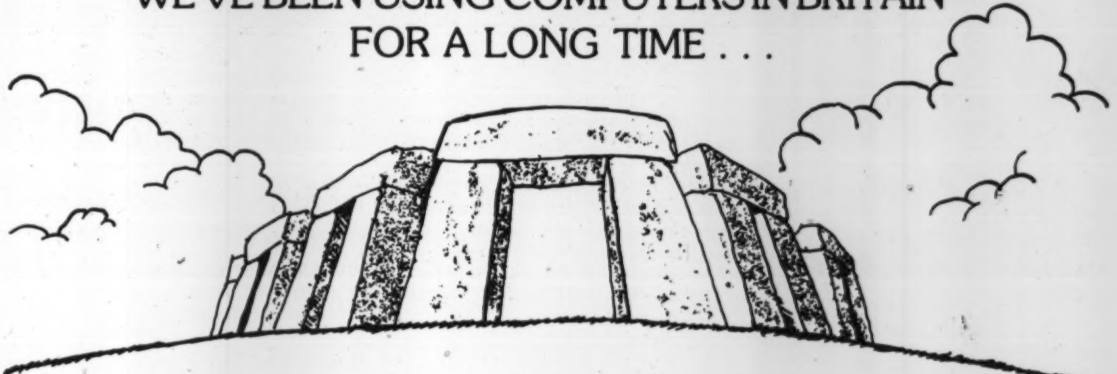

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New Products, continued...

for high school and college students. $24.95. T Y C Software, 40 Stuyvesant Manor, Geneseo, NY 14454. (716) 243-3005.

CIRCLE 379 ON READER SERVICE CARD

Radio Shack has announced a learning system for the TRS-80 Color Computer, the **Talk/Tutor System**. The new system presents numbers, upper- and lower-case text, high resolution pictures recorded by a television camera and processor, and audio. It requires a Color Computer, TV set and cassette player. Radio Shack plans to offer "a variety of instructional programs for both home and classroom that run on the new system."

Quality Educational Designs has introduced **Arith-Magic**, a disk whiich includes: Diffy, "the case of the disappearing differences; Tripuz, an addition or multiplication puzzle; and Magic Squares, an exploration of patterns. The programs are interactive and appropriate for grades 3 to 8. The package is available for 32K Apple with DOS 3.3 and the 32K TRS-80 Model I or III. $35. Quality Educational Designs, P.O. Box 12486, Portland, OR 97212. (503) 287-8137.

CIRCLE 381 ON READER SERVICE CARD

Grade Reporting System enables school administrators to produce report cards and auxiliary print-outs using any computer that runs under CP/M using Microsoft Basic-80, including Apple and TRS-80 Models I, II, and III. The menu-driven software package serves schools up to 2000 students. Applied Educational Systems, RFD 2, Box 213, Dunbarton, NH 03301. (603) 774-6151.

CIRCLE 382 ON READER SERVICE CARD

The Attendance Reporting System provides reports needed by elementary and secondary schools to account for student absenteeism and tardiness. It can accommodate a school of any size, and provides eight user-defined absence categories. The system requires a 64K Apple with two 16-sector disk drives and printer. $550. Educational Services Management Corporation, Dept. M, P.O. Box 12599, Research Triangle Park, NC 27709. (919) 781-1500.

CIRCLE 383 ON READER SERVICE CARD

The Comprehensive Power Program is a computer-based reading improvement program, which inductively develops 25 comprehension and study skills through preview skimming and comprehensive reading practice in the areas of literal understanding, interpretation, evaluation, appreciation, and analysis. It is available for the 48K Apple. Instructional/Communications Technology, Inc., 10 Stepar Pl., Huntington Station, NY 11746. (516) 549-3000.

CIRCLE 384 ON READER SERVICE CARD

The Attendance Tracking System for the Apple II is designed to automate student attendance record keeping, accommodating continuous attendance record keeping for one to eight periods per day for 180 days. Edu-Comp, Inc., 14109 S.E. 168th St., Renton, WA 98055. (206) 255-7410.

CIRCLE 385 ON READER SERVICE CARD

BUSINESS

Supercalc is an electrical worksheet program for CP/M compatible systems, including Zenith Z-89, Apple, Xerox 820, North Star, Superbrain, Micropolis, Osborne 1 and Vector Graphics computers. It prepares an electronic ledger on the display and permits the user to enter text or numeric information and perform calculations. It can also be used with other programs which run under the CP/M operating system. The program requires 48K of memory and is available on 5 1/4" or 8" disks. $295. Sorcim Corporation, 405 Aldo Ave., Santa Clara, CA 95050. (408) 727-7634.

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Property Listing and Comparables from Realty Software is designed to create and maintain property listing information and provide screened property listings for prospective buyers, as well as comparable listings for appraisals. Up to 1000 listings may be stored on one diskette. Realty Software Company, 116 F 8th St., Manhattan Beach, CA 90266. (216) 372-9419.

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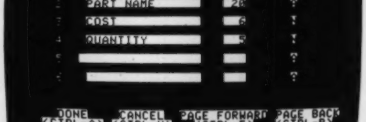
Personal Software has announced **VisiFile**, a file management program designed to handle record filing, searching, sorting, printing reports and mailing labels. The program, which is controlled by a "moving cursor menu," can communicate with other Personal Software products such as VisiCalc, VisiPlot and VisiTrend. A 48K Apple with language card or Applesoft Basic card and one disk drive is required; two disk drives and a printer are recommended. $250. Personal Software, Inc., 1330 Bordeaux Dr., Sunnyvale, CA 94086. (408) 745-7841.



```
VISIFILE - DEFINING A FILE
FILE NAME INVENTORY    FORMAT AUTOMATIC
FIELD#    FIELD NAME      SIZE  DATA TYPE
  1       PART NUMBER      15      T
  2       PART NAME        20      ?
  3       COST              6      T
  4       QUANTITY          5      T
  5                                ?
  6                                ?
```

The Paymaster Payroll System processes up to 100 employees in any combination of payroll periods from daily to yearly. Features include the ability to print any screen, as well as standard reports and programs. The system is available for the 48K Apple II Plus with two to four disk drives and printer. Masterworks Software Inc., 1823 W. Lomita Blvd., Lomita, CA 90717. (213) 539-7486.

CIRCLE 389 ON READER SERVICE CARD

Lifeboat Associates has introduced **The Boss**, an accounting system that combines accounts payable, accounts receivable and general ledger so they can be accessed at any time during the program run. The program offers the ability to produce comprehensive financial ratio analyses, loan payment calculations, amortization schedules, depreciation schedules and statements of changes in financial position. It runs under CP/M and can be used on a variety of microcomputers. $24.95. Lifeboat Associates, 1651 Third Ave., New York, NY 10028. (212) 860-0300.

LIFEBOAT ASSOCIATES

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Sales Tax Calculator, designed for small businesses which report state sales tax quarterly, will hold up to 500 entries on a 16K TRS-80 Model I or III and 1500 on a 32K machine. All data may be dumped to tape and retrieved later for review if hard copy storage is not desired. $14.95. Manhattan Software, P.O. Box 1063, Woodland Hills, CA 91365. (213) 704-8495.

CIRCLE 391 ON READER SERVICE CARD

Trend-Spotter is a business graphics and forecasting analysis package which will generate color graphic displays, calculate trend lines, perform mathematical and statistical computations, print graphic and tabular data, and edit and update data files. It can also generate and read VisiCalc-compatible files. The program requires a 48K Apple II Plus with Applesoft, disk drive and monitor. $175. Software Resources, Inc., 186 Alewife Brook Pkwy., Suite 310, Cambridge, MA 02138. (617) 497-5900.

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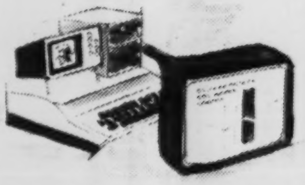

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The Video Buyers Edge.

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